

Flight, May 17, 1917.

FLIGHT

First Aero Weekly in the World.

Founder and Editor : STANLEY SPOONER.

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport.

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

No. 438. (No. 20, Vol. IX.)

MAY 17, 1917.

[Weekly, Price 3d.
Post Free, 4d.]

Flight.

Editorial Office : 44, St. MARTIN'S LANE, LONDON, W.C.2.

Telegrams : Truditur, Westrand, London. Telephone : Gerrard 1828.

Annual Subscription Rates, Post Free.

United Kingdom .. 15s. 2d. Abroad 20s. od.

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EDITORIAL COMMENT.

EROM all over the country come reports of labour unrest, which in several instances has resulted in strikes of greater or less magnitude. From the point of view of the nation, that of the engineers is the most serious, inasmuch as its continuance would have meant that our armies which are fighting the country's battles overseas must have suffered from the want of shells, guns and aeroplanes, the output of which must have been seriously curtailed. Almost as bad is the strike of the London omnibus workers, which has also a very direct effect upon the output of munitions, since the omnibus services cover all the London munitions areas and very many of the workers are dependent upon these services to get to and from the scene of their labours. Obviously, so many hours' work lost by these people means a corresponding lessening of the output of munitions. Strikes of any kind in a time like that through which the Empire is passing now are criminal. At any time, they are a crude resort from which, as a rule, neither employers nor men gain very much in

The Spread of the Strike Fever. The spread of the strike fever, which has also a very direct effect upon the output of munitions, since the omnibus services cover all the London munitions areas and very many of the workers are dependent upon these services to get to and from the scene of their labours. Obviously, so many hours' work lost by these people means a corresponding lessening of the output of munitions. Strikes of any kind in a time like that through which the Empire is passing now are criminal. At any time, they are a crude resort from which, as a rule, neither employers nor men gain very much in

the end, except perhaps the concession of a principle by one side or the other. Take, for example, the case where men strike over a question of money, and remain out for any length of time. Supposing they gain their point in the end, how long is it before they are any better off for it? They have been weeks doing nothing, with nothing coming in, and after they return to work it requires months at the higher rate to overtake the loss of earnings incurred during the period of the strike. It seems to us to be, generally speaking, an utterly illogical method of settling disputes. Of course, in normal times if people like to cut off their noses to spite their faces it is usually nobody's direct concern but their own, but times are different now.

So far as the engineers' strike is concerned, there seems to have been some little blame attaching to the Ministry of Munitions, which failed to make clear the exact meaning of the abolition of the "trade card" or to show that the scheme would not really affect the skilled workers. But when that has been said, all the excuse that we are able to see that the strikers can advance has been admitted. All that matters in the present emergency is that the army wants men and it wants munitions—guns, rifles, shells, aeroplanes, in ever-increasing quantities. And, what is more, it is up to the Government to deal with a strong hand with all and any who dare to delay by a matter of seconds the turning out of all that the army requires. It is a pathetic commentary on the way the Government deals with these labour troubles that it is stated that very many of the men who "came out" actually did not know what they were striking about! If that is indeed so, and we see no reason to think otherwise, then what about the agitators who engineered the affair? Are they in gaol? Or are the authorities afraid to put them there? If they are not already under lock and key, and if the Government is not afraid of them, may we be told how soon they are to be gathered in? Mr. Bonar Law told the House of Commons on Friday of last week that "the Government must take immediate action against those responsible for the interference with the output of munitions so urgently required." Surely the time to have acted was while the strikes were being fomented and when the incipient trouble could have been nipped in the bud. If indeed the men themselves did not know what the trouble was about, it is quite clear that a number of irresponsible agitators were at work stirring up trouble,

and all that was necessary was to have got them out of the way at once. Then, if the men had been taken into the confidence of the Ministry of Munitions with regard to the trade card scheme and the proposed further dilution of labour, there need have been no strikes. Neither was done, apparently, and thus we have to add to the history of the war a further regrettable page, which will not only have the effect of retarding the supply of vitally necessary munitions to the army, but will most certainly have the effect of heartening the enemy, who will read into these stories of labour troubles an evidence that we are a house divided.

By an irony of coincidence it was during the engineers' strike that Sir Douglas Haig's letter to the Minister of Munitions was published, in which he tenders the thanks of himself and the armies under his command to the workers who have "made great efforts to supply the army with all its needs, not only in guns and ammunition, but also with rifles, and other munitions, aircraft, tanks, transport, &c." Sir Douglas adds: "I know we can rely on all workers at home to maintain these efforts so that the army may lack nothing in the further fighting that lies ahead." It begins to look as though he were a good deal too optimistic in the matter of "all workers at home." Unquestionably, the workers as a whole have done magnificently, but unfortunately there is a substantial minority which is far more jealous of its "rights" than it is of the lives of its fellow workers who are fighting to maintain the right of those at home to live their own lives. They are willing to work as long as they get all they want, but the moment they think there is a chance of getting a little more than they are entitled to they do not boggle for a moment at the means to be adopted to secure it. That those means may entail the sacrifice of the lives of hundreds of our soldiers is nothing to them—their precious skins are safe, and that is all they care about.

What a Contrast!

In pleasant contrast to the attitude of the agitators who for purposes of their own are fomenting industrial unrest, and of the egregious Independent Labour Party, is that of Mr. John Hodge, the Minister of Labour, and Mr. Victor Fisher, in their respective capacities of president and hon. secretary of the British Workers' League, who have issued a very straight-talking manifesto on behalf of their executive committee. The I.L.P. at its Easter Conference passed a resolution instructing its delegates to the next International Socialist Congress to endeavour to secure assent to a declaration which would have the effect of pledging Socialists of all countries to refuse to support any future war entered into by their respective Governments, whatever the ostensible objects of the war, and even if such war is represented by any Government, to be of a defensive character. In a word, asking the Socialists of the world to declare themselves to a man to belong to that most loathsome of all types, that of the "Conscientious Objector."

The text of the manifesto is well worth quoting. It says:—

"This incomprehensible and indefensible resolution of the Independent Labour Party demands an emphatic and immediate repudiation by British Labour. The Independent Labour Party absolutely rejects the use of force to preserve liberty, to secure a wider measure of justice, to abolish tyranny! By what right do they claim to represent free men? How has our present freedom been gained otherwise

than by resisting those who in the past have striven to keep the workers in subjection? The trade unionists of this country, the beginning of whose organization dates from a resolve to resist oppression, from a desire to share in the fruits of their own labour, cannot view the resolution of the Independent Labour Party with other than a feeling of contempt for the ignorance and servility it displays.

"All the past of the Independent Labour Party is a denial of its last resolution—a resolution that condemns the Independent Labour Party as a group of doctrinaires who, mouthing pious phrases about the brotherhood of man and the ennoblement of human life, dare not fight for either ideal against the encroachments of reactionary or aggressive forces. Their policy and propaganda are welcomed by the Kaiser's Government; but what right have they to the support of any man who regards his honour and his liberty as sacred, and which the State must cherish and defend, or perish?

"We hope that the International Socialist Congress, whenever it meets, will repudiate the Independent Labour Party's resolution. We believe, with the greatest confidence, that the workers of Britain will deny the right of any organization to submit in their name to the workers of the world a resolution such as this, which, while binding those countries which have attained to a free democratic and constitutional form of government, would not restrain autocratic and militarist Governments from waging aggressive wars, despite the opposition of their democratic and Socialistic parties who may have subscribed to the terms of the resolution under notice."

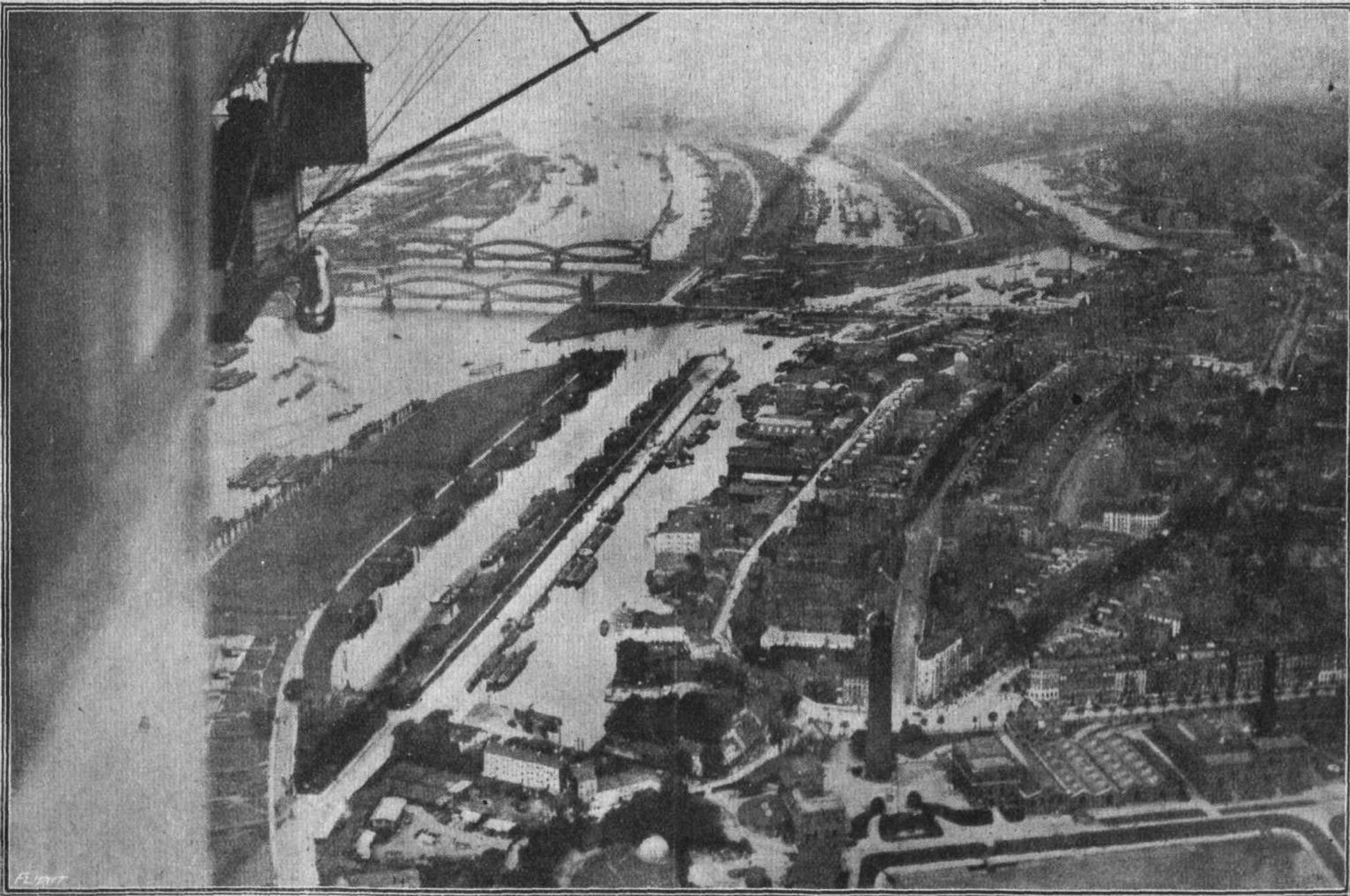
That is straight talk and good talk. Moreover, it is the kind of talk that is the most likely to appeal to the people of the Empire. To ask them to subscribe to the doctrines of the I.L.P. as set forth in the resolution which is attacked by Mr. Hodge is nothing more nor less than an insult to their intelligence. We are in the most complete agreement with the ideal of no more war. The world has suffered too terribly from the present cataclysm, which has grown out of the insane ambition for power of a small group of men with the power to sway the issues of peace and war for us to want any more of it. But the way to avert future upheavals does not lie in the formulation of pious resolutions like that of the I.L.P. If these people had the faintest glimmerings of intelligence they would realise that the adoption of such doctrines is in fact the surest way to bring about the very result they are directed against. What, for example, was one of the most potent factors in deciding the Kaiser and his entourage to declare war three years ago? The belief that the British Empire would be found to be a house divided against itself. They believed that we should be faced with rebellion throughout the dominions and that our hands would be so full with its suppression that we should be a *quantite negligible* in the main issues of the war. Had they foreseen that the whole Empire would rally to the flag in the way it has, does anyone think there would have been war? At least it is permissible to say that it is very highly probable there would not.

What these pundits of the I.L.P. forget is that resolutions and pledges are of no effect at all unless the machinery exists for enforcing their performance. No doubt the German Socialists would be delighted to subscribe to the pledge, but would they observe it if war came? We do not think so for a moment. We should find once more that they were Germans first and Socialists afterwards. And, be it said, we should think worse of them than we do—if that is possible—were they anything else.

**Aircraft
to Combat
Submarines.**

Lord Montagu, in a letter to the *Times*, again draws attention to the necessity for the use of aircraft in combating the submarine menace. We know that recently much more has been done than

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REPRISALS, AND WHAT OUR PILOTS MAY BE ABLE TO RECOGNISE.—Hamburg Harbour, as seen from one of the Zeppelin airships.

FLIGHT

in the past in the direction of employing seaplanes and small airships for the detection of these pests of the sea, but Lord Montagu makes a very pertinent enquiry when he asks if full advantage is being taken of the skill and experience of the officers who, before the war and since, have realised the immense importance of aircraft as the eyes of a fleet. Lord Montagu : asks : "Without wishing to embarrass the Admiralty, may we ask is their general attitude, as distinct from the Navy, really sympathetic even now?" Not very long ago, says Lord Montagu, seaplanes were referred to by a senior official as "those toys." As he says, toys in the nursery and in real life have a habit of affecting the destinies of the world. George Stephenson's "Rocket," the first motor-car, and the Wrights' first glider were "toys" in that sense. "We who believe in the future of aircraft smile to ourselves when we think what our toys will do in a few years, both on sea and land."

Lord Montagu hardly needed to have dipped into the future to point the possibilities of the "toys." He surely need not have gone beyond the immediate present. Already aircraft have revolutionised war, to say nothing of what they have done in other directions. It is that fact alone that makes one think that an official, be he senior or junior, who has so little imagination or knowledge as to describe seaplanes as "toys" ought to be retired out of hand. He is of no use to the country in any official position connected with either of the fighting services. It was precisely the attitude of mind adopted by this particular official that caused us to drop into war without an effective air service, such as our enemies had created for our undoing. Before the war our administrative services were, so far as aircraft were concerned, divided into two main sections : the mockers and the cheese-parers. There was a small leavening of men with imagination, and it was to them we owed the fact that we had an air service of any sort at all. The policy of mockery and parsimony was bad enough then, but what are we to think of it now? What better argument do we want in favour of the creation of a separate air service than this chance remark of some "senior official"? Seeing that the spirit of conservatism is still abroad, and that there are still people possessed of the power to hold things back and who think of aircraft as "toys," we ought to place the whole control of our air services in the hands of men who know all the possibilities and invest them with the necessary powers to ensure a development in consonance with the needs of the Empire. There has been more than enough of piffing. The only one thing to be done is to remove the future from the possibility of interference by the pifflers.

Lord Derby and the Air Services. In opening an Air Service Exhibition at Liverpool last week, the Secretary of State for War had a great many interesting things to say of the work of the air services at the Front. After reviewing the past, Lord Derby delivered himself of the very true

pronouncement that : "The only thing we have to think of is the supremacy of invention, which is just as important as supply." Undoubtedly it is, and it is good to realise that the fact is recognised by those at the head of the Services. We cannot have a monopoly of invention, which fact has emerged from time to time when the Germans have been able to go one better than ourselves in the matter of aircraft, but we can encourage the inventor to give us of his best. Lord Derby told his audience that he believed the best brains of the country were busy with the subject of improvement of aircraft. That is a very reassuring statement, coming from the quarter it did, though we should like to feel as certain as his lordship that all the encouragement possible is being given to those who, though not in the inner swim of things, are doing much valuable work in the development of the movement. However, that is more or less by the way.

Turning to the matter of supply, Lord Derby said :—

"I hope you will not take it out of place on my part if I draw the attention of those responsible for the manufacture of those machines to the grave danger to our Air Service and men, by any stoppage of work at such a moment as this. The loss of a day in a workshop may mean the loss of 100 lives on the battlefield, and I ask those engaged in the manufacture of these instruments of war to consider the position most carefully and be certain that they do all they can to help the Flying Corps in their arduous and dangerous work."

Is the argument, we wonder, likely to appeal to the strikers and agitators who have been, and are now, holding up production for the attainment of their own selfish ends? Let them ponder it—the loss of one day in a workshop may mean the loss of a hundred lives on the battlefield? There is no need to press the point so admirably put by the Secretary for War—it stands there for those at whom it is directed to interpret for themselves.

* * * * *

The Honours of the R.F.C. On the same occasion as that to which we have referred above, Lord Derby gave his audience some particulars of

the war honours already gained by officers and men of the R.F.C. These include no fewer than seven V.C.'s, 72 D.S.O.'s, 304 Military Crosses, 97 Military Medals, 54 D.C.M.'s, 53 Meritorious Service Medals, and 486 "mentioned in despatches." In addition, there have been innumerable awards of decorations by the Governments of Allied nations. All these, too, take no account of the honours awarded to the officers and men of the R.N.A.S., which would swell the total very considerably indeed.

When it is remembered that these decorations are not thrown about like Iron Crosses, but that the British officer or man has really to do something a lot out of the ordinary to gain the award of even the humblest of them, we are able to realise to some small extent what a magnificent record of good service lies behind the service which was really brought into being through the war. It is eloquent of a record that will remain a source of legitimate pride to the nation and the Corps so long as Time shall endure.

* * *

A Technical Committee of the Motor Industries.

A NEW Committee has been formed by the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders, in order to co-ordinate the many technical questions which arise in connection with the automobile industry. Invitations to be represented on the Committee have already been accepted by the following : National

Physical Laboratory (Dr. Stanton), G.P.O. (Capt. Wheeler), Institution of Mechanical Engineers (Dr. Hele-Shaw), Iron and Steel Institute (Mr. J. H. Dickenson). Among other work which the new Committee will take over is that of the research on the E.S.C. British standard steels for aircraft. The joint secretaries are Mr. Basil H. Joy, I.A.E., 28, Victoria Street, S.W.1, and Mr. J. F. Woodfine, S.M.M.T., 83, Pall Mall, S.W.1.

HONOURS.

Honours for the R.N.A.S.

In a supplement to the *London Gazette* dated May 12th it was announced that the King has been pleased to give orders for the appointment of the following officers to be Companions of the Distinguished Service Order:—

Capt. CHARLES LAVEROCK LAMBE, R.N.

For his valuable services in command of the R.N.A.S. units on the Belgian coast; he is very largely responsible for the good service in the varied duties carried out by them against the enemy.

Sqn.-Comdr. GEOFFREY RHODES BROMET, R.N.

This officer commanded a squadron of the R.N.A.S., attached to the Flying Corps, with conspicuous ability and success. Under his command the squadron developed into a most efficient and formidable fighting force, which has brought great credit to the Royal Naval Air Service.

Sqn.-Comdr. EDWARD THOMAS NEWTON-CLARE, R.N.A.S.

During the past year he has led his squadron with conspicuous success in numerous bomb attacks, and on many occasions has engaged and driven down hostile machines.

The King has been pleased to approve of the award of the Distinguished Service Cross to the following officers:—

Flt.-Comdr. BERTRAM LAWRENCE HUSKISSON, R.N.A.S.

For conspicuous skill and gallantry during the past 18 months. This officer led his flight with great courage and determination during the three months he was attached to the R.F.C., and has destroyed or driven down several hostile machines.

Flt.-Lieut. (now Flt.-Comdr.) ARTHUR DENNIS WIGRAM ALLEN, R.N.A.S.

This officer has done a very large amount of flying during the past nine months on fast scouts on fighter patrol work. In addition, he has done a great deal of testing work at the aircraft dépôt. He is a brilliant pilot.

Flt.-Lieut. (now Flt.-Comdr.) BERTRAM CHARLES BELL, D.S.O., R.N.A.S.

For conspicuous skill and gallantry during the last 15 months. This officer has had charge of a flight during this period, and has continuously carried out most valuable work as a pilot both of reconnaissance and photographic and of fighter escort machines. His machine has been constantly under heavy anti-aircraft fire for long periods while carrying out his work.

Flt.-Lieut. (now acting Flt.-Comdr.) FRANK FOWLER, R.N.A.S.

For conspicuous skill and gallantry during the last nine months in reconnaissance, photographic and spotting machines. On the majority of occasions he has acted as pilot to Lieut. Gow, R.N.V.R., his machine being constantly hit by anti-aircraft fire.

Flt.-Lieut. FRANK THOMAS DIGBY, R.N.A.S.

For conspicuously good work as a pilot of bombing machines. He has taken part in numerous bomb raids with successful results.

Flt.-Lieut. HERBERT GEORGE BRACKLEY, R.N.A.S.

For conspicuously good work as pilot of a bombing machine. Has carried out 12 raids since June 1st, 1916, mostly by night. On one occasion he returned with 40 holes in his machine.

Flt.-Lieut. NOEL KEEBLE, R.N.A.S.

For conspicuous gallantry on October 23rd, 1916, when he attacked four German seaplanes and brought one of them down in a vertical nose-dive into the sea.

Flt.-Lieut. THOMAS FREDERICK LE MESURIER, R.N.A.S.

For conspicuous work as a pilot of a bombing machine. Has taken part in 14 raids and numerous fighter patrols.

Flt.-Lieut. IRWIN NAPIER COLIN CLARKE, R.N.A.S.

For conspicuously good work as a pilot of bombing machines. He has taken part in 17 attacks with good results, in addition to carrying out numerous fighter patrols.

Flt.-Lieut. ROBERT JOHN ORTON COMPSTON, R.N.A.S.

For conspicuous skill and gallantry during the past nine months, in particular when attached to the R.F.C., when he had numerous engagements with enemy aircraft, and certainly destroyed one.

Flt.-Lieut. WILLIAM EDWARD GARDNER, R.N.A.S.

For conspicuously good work as a pilot of a bombing machine. He has taken part in 17 raids and numerous fighter patrols.

Lieut. RUSSELL WILLIAM GOW, R.N.V.R.

For consistently good work when acting as observer, being responsible for many valuable photographs; also for his good work in connection with artillery spotting. His machine has been hit on many occasions by anti-aircraft fire.

Flt. Sub-Lieut. PHILIP SYDNEY FISHER, R.N.A.S.

For conspicuous skill as a seaplane pilot during the last nine months. Has carried out many valuable reconnaissance patrols and several bomb attacks with good results.

Flt. Sub-Lieut. DOUGLAS ALEXANDER HARDY NELLES, R.N.A.S.

For conspicuously good work as a pilot of a bombing machine. He has taken part in 17 raids, and has also done a large amount of fighter patrol work.

Flt. Sub-Lieut. ERNEST JOHN CUCKNEY, R.N.A.S.

For conspicuous gallantry and ability when taking part in a raid on the seaplane station at Zeebrugge.

Flt. Sub-Lieut. JOHN EDWARD SHARMAN, R.N.A.S.

For devotion to duty during long-distance air raids. On one occasion, after leading a flight in the morning and returning safely, he volunteered and flew a bombing machine with a second flight in the afternoon, again acting as leader.

Flt. Sub-Lieut. WALTER ERNEST FLETT, R.N.A.S.

For conspicuous gallantry during an air raid. Shortly after leaving the objective he was engaged with three enemy machines—two single-seaters and one two-seater. His gunlayer, Air-Mechanic, 1st Grade, R. G. Kimberley, was slightly wounded in the wrist, which numbed his hand. Notwithstanding this, he succeeded in bringing down two of the enemy machines, being again wounded by an explosive bullet in the ankle. The machine was riddled with bullets, and owing to the damage, navigation was most difficult, and the return journey was very slow. Consequently he was again attacked, but although the gunlayer was twice wounded, the enemy machine was driven off.

The King has further been pleased to approve of the award to the following officer of a Bar to the Distinguished Service Cross:—

Flt.-Lieut. RONALD GRAHAME, D.S.C., R.N.A.S.

For conspicuous gallantry during raids on the seaplane station at Zeebrugge. On one occasion he descended to 600 ft., and on another occasion to 300 ft., before releasing his bombs. (Award of D.S.C. was announced in *Gazette* dated Oct. 25th, 1916.)

The following awards have also been approved:—

To receive the Distinguished Service Medal.

P.O. Mech. WALTER LAURENCE, O.N. 300142; P.O. Mech. FREDERICK HENRY WINSTONE, O.N. F570; C.P.O. Mech., 3rd Gr., GEORGE FREDERICK RIDGEWAY MARDEN, O.N. F 4718; P.O. Mech. WILLIAM STEPHEN BURVILLE, O.N. F4117; C.P.O. Mech., 1st Grade CHARLES HAROLD POTTS, O.N. M1008; C.P.O. Mech., 3rd Grade HERBERT ERNEST PHILLP, O.N. F6491; Ldg. Mech. JOHN McCREDIE, O.N. F148; P.O. Mech. EDWARD WILLIAM DAWSON, O.N. F1748; P.O. Mech. ALEXANDER BELL, O.N. F2422; Ldg. Mech. CHARLES THOMAS, O.N. F2350; C.P.O. Mech., 1st Grade, HENRY HERBERT SMITH SCOTT, O.N. 345608; C.P.O. Mech., 3rd Grade, JOHN ARCHIBALD ROSLING, O.N. F81; P.O. Mech. FREDERICK THOMAS MCSORELY, O.N. F1223; C.P.O. Mech., 3rd Grade, BERT ARVOY, O.N. F672; P.O. Mech. FERDINAND FANTINI, O.N. F2489; Ldg. Mech. WILLIAM FREDERICK CLIFFE, O.N. F6074; P.O. Mech. SAMUEL PERCY FINCH, O.N. F599; P.O. Mech. WILLIAM ERNEST WATSON, O.N. F593; Air-Mech., 1st Grade, ROBERT GEORGE KIMBERLEY, O.N. F4766.

Mentions in Despatches.

The following officers and men have been mentioned in despatches:—

Wing-Comdr. CHRISTOPHER LLOYD COURTNEY, R.N.; Fleet Payt. FREDERICK RICHARD WAYMOUTH, R.N.; Actg. Wing-Comdr. ALEC OGILVIE, R.N.A.S.; Sqn.-Comdr. FRANCIS ESMÉ THEODORE HEWLETT, R.N.; Flt.-Comdr. WILLIAM LAWRIE WELSH, R.N.A.S.; Acting Flight-Comdr. ROBIN GORDON MACK, R.N.A.S.; Acting Flight-Comdr. BRYAN CHARLES CLAYTON, R.N.A.S.; Flight-Lieut. GRANT ARMSTRONG GOODERHAM, R.N.A.S.; Flight-Lieut. CHARLES DAWSON BOOKER, R.N.A.S.; Lieut. LIONEL EDWIN INNES-BAILLIE, R.M.A.; Lieut. OLIVER GEORGE GRAHAM VILLIERS, R.N.V.R.; Lieut. RONALD GEORGE ST. JOHN, R.N.V.R.; Flight Sub-Lieut. JEAN DE FRANCIS, R.N.A.S.; Flight Sub-Lieut. FRANCIS DOMINE CASEY, R.N.A.S.

W.O., 2nd Grade, THOMAS MARTIN, R.N.A.S.; Acting W.O., 2nd Grade, NORMAN LITTLEJOHN, R.N.A.S.; P.O. Mech. ROLAND ALFRED SIBURN, O.N. F2418; P.O. Mech.

WALTER GEORGE JONES, O.N. J5596; C.P.O. Mech., 3rd Grade, ALFRED ERNEST LE SUEUR, O.N. F3413; Ldg. Mech. OLIVER DOUGLAS ROBSON, O.N. F4735; P.O. Mech. REGINALD ARTHUR CLARKE, O.N. F3896; Air-Mech., 1st Grade, JOHN MCKIMMIE YOUNG, O.N. F3652; P.O. Mech. DONALD BRIGHAM, O.N. F641; P.O. Mech. PHILIP HIRAM DIMMICK, O.N. F1207; Air-Mech., 1st Grade, FREDERICK JOHN GEORGE, O.N. F1997; P.O. Mech. SIDNEY JOHN PETTS, O.N. F1717; Air-Mech., 1st Grade, ALFRED DUNN, O.N. F9172; Ldg. Mech. EDGAR HAROLD RESTALL, O.N. F2468; Air-Mech., 1st Grade, FRANCIS GEORGE PARKER, O.N. F2358; P.O. Mech. WILLIAM ARTHUR HILL, O.N. F4596; P.O. Mech. HORACE DAWSON, O.N. F4755; P.O. Mech. ALFRED HERBERT DOYLE, O.N. F4214; Air-Mech., 1st Grade, FREDERICK METCALF, O.N. F8944; C.P.O. Mech., 3rd Gr., WILLIAM WILSON POPE, O.N. F1712; P.O. Mech. WILLIAM GRIFFITHS, O.N. F8339; Ldg. Mech. JOHN BALFOUR NESBITT, O.N. F2390; Air-Mech., 1st Grade, ROBERT JOHN HEPWORTH, O.N. F2175; Ldg. Mech. THOMAS HENRY CROSS, O.N. F976; Ldg. Mech. SEPTIMUS NEWBURY, O.N. F1209.

Rewards for the R.F.C.

It was announced in a supplement to the *London Gazette* issued on May 11th that the King has been pleased to confer the Military Cross on the following officers in recognition of their gallantry and devotion to duty in the field:—

Temp. 2nd Lt. WILLIAM BAILLIE, Gen. List and R.F.C.

Although very severely wounded during a combat with hostile aircraft, he succeeded in bringing his own machine back and effecting a safe landing.

2nd Lt. EDMUND BARRY CAHUSAC, S. Staff, R., Spec. Res., attd. R.F.C.

He carried out a successful artillery observation on a hostile battery in very adverse weather. He worked for two and a half hours at a height of 1,500 to 3,000 ft. under very heavy fire. On another occasion, while engaged on photography, he drove off three hostile scouts and completed his work.

Capt. DOUGLAS REGINALD GAWLER, R. Scots and R.F.C.

For consistent good work whilst carrying out artillery observation and for gallantry on many occasions. On one occasion he continued his observation work in spite of being attacked by several hostile machines and in spite of being under very heavy fire.

2nd Lt. ROBERT HAMILTON, High. Cyclist Bn., attd. R.F.C.

As an observer he carried out a successful artillery observation on a hostile battery in very adverse weather. He worked for 2½ hours at a height of 1,500 to 3,000 ft. under very heavy fire. On another occasion, whilst engaged in photography, he drove off three hostile scouts and completed his work.

Temp. Sec. Lt. WILLIAM DRUMMOND MATHESON, Gen. List and R.F.C.

In leading a formation of eight machines against 16 of the

enemy he drove down one hostile machine and eventually succeeded in landing his machine safely in spite of being attacked by several enemy machines. On other occasions he has brought down four hostile machines.

Temp. Capt. LANCELOT LYTTON RICHARDSON, Gen. List and R.F.C.

He attacked a formation of five hostile scouts, and brought two of them down. On another occasion, although himself wounded, he destroyed two hostile machines and drove down, damaged, at least two others.

Lt. (Temp. Capt.) DONALD CAMPBELL RUTTER, R. Suss. R., Spec. Res. and R.F.C.

He completed a valuable reconnaissance alone at a very low altitude and in face of heavy fire, which riddled his machine. On another occasion, he, single-handed, succeeded in driving off three hostile machines.

2nd Lt. REGINALD FRANCIS BAILLIEU, R.F.C.

Accompanied by his observer, he descended to the rescue of a pilot who had been forced to land and who had set his machine on fire. He landed safely on difficult ground, and in spite of the close proximity of the enemy, succeeded in rescuing the pilot and in carrying off his two passengers under a close and heavy rifle fire.

Lt. ROSS MACPHERSON SMITH, Aust. Light Horse R., attd. Aust. R.F.C.

For conspicuous gallantry and devotion to duty when his pilot descended to the rescue of an officer who had been forced to land. On landing he held the enemy at bay with his revolver, thus enabling his pilot to rescue the officer and to safely fly away his machine.

THE King has been pleased to approve of the award of the Distinguished Conduct Medal to the following for acts of gallantry and devotion to duty in the field:—

3516 Sergt. G. J. MACKIE, R.F.C.

35972 Sergt. J. F. RIDGWAY, R.F.C.

THE King has been pleased to award the Military Medal for bravery in the field to the undermentioned:—

28941 2nd Air-Mech. F. BOND, R.F.C.

8124 1st Air-Mech. H. BOULTON, R.F.C.

32925 1st Air-Mech. P. CRAIG, R.F.C.

17942 2nd Air-Mech. J. DUNN, R.F.C.

25674 2nd Air-Mech. W. KNIGHT, R.F.C.

4151 Cpl. W. TURTON, R.F.C.

61869 2nd Air-Mech. E. WOOD, R.F.C.

Military Medal for Anti-Aircraft Men.

Among the list of names published on May 11th to whom the Military Medal for bravery in the field has been awarded appear the following:—

M.2/052233 Lc.-Cpl. N. McLEAN, A.S.C., attd. Anti-Aircraft Battery.

150107 Sergt. A. MORRIS, R.F.A., attd. Anti-Aircraft Battery.

ROYAL AERO CLUB OF THE U.K. OFFICIAL NOTICES TO MEMBERS.

HOUSE COMMITTEE.

A MEETING of the House Committee was held on Friday last, the 11th inst., when there were present:—Mr. J. H. Nicholson, in the chair, Mr. C. G. Greenhill, Mr. Henry Knox, Mr. J. Stewart Mallam, Mr. J. H. Spottiswoode and the Assistant Secretary.

House Accounts.—A Profit and Loss Account for the month of April was submitted, which showed that the House Finances were very satisfactory.

Billiard Room.—The arrangements for the Billiard Room were completed.

Club House.

The following prices have been fixed for the present by the Committee:—

Bedroom (including Bath)	5s. each per night.
Breakfast	2s. 6d.
House Luncheon	2s. 6d.
House Dinner	3s. 6d.

Billiard Room.

The Billiard Room is now open for the use of the Members.

Flying Services Fund.

Boxes for collecting subscriptions for the Flying Services Fund are now available, and anyone wishing to have a box can obtain the same on application to the Secretary.

THE FLYING SERVICES FUND administered by

THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 3, Clifford Street, New Bond Street, London, W. 1.

Subscriptions.

	£	s.	d.
Total subscriptions received to May 8th, 1917..	11,739	4	4
W. A. Ross	1	0	0
Collected by W. Davis	1	5	8

Total, May 15th, 1917 11,741 10 0

B. STEVENSON, Assistant Secretary.
3, Clifford Street, New Bond Street, W. 1.

THE "TOTALLY ENCLOSED" AEROPLANE.

(Concluded from page 448.)

HAVING briefly reviewed, in preceding issues of "FLIGHT," the more important of the "enclosed" aeroplanes that have been constructed up to the present, a short résumé of the advantages and disadvantages of the different types may be helpful in forming an opinion of the lines along which progress is likely to be made in the future with this type of machine.

Practically speaking, the tractor type of enclosed aeroplane, whether monoplane or biplane, suffers from one common fault, *i.e.*, the view in a forward direction is badly restricted owing to the presence of the engine. In those of the machines reviewed in which the engine was mounted high so as to improve the view to a certain extent, it was generally concluded that the centre of thrust was somewhat too high, thus introducing an aerodynamical disadvantage tending to minimise or even nullify the practical advantage of this arrangement. In the Curtiss Autoplane an attempt has been made to overcome this difficulty by placing the engine in front but very low down, where the pilot can easily look over and beyond, and by employing shaft drive to a propeller placed at the rear end as near as it is possible to judge without knowing results of wind tunnel tests, on or very close to the centre of resistance.

The only "pusher" of the enclosed type, properly speaking, was the Blériot Aerocar, built for Mons. Deutsch de la Meurthe. In this both engine and air screw were placed at the rear, or, in other words, well out of sight as regards the pilot's view, but this machine, it can be easily seen in the light of modern knowledge, suffered from other drawbacks such as excessive head resistance formed by the large flat front of the cabin and by the numerous outriggers carrying front elevator and tail planes. Also the machine was probably too heavily loaded, being of the monoplane type and designed to carry five persons.

Of the large machines that have been or could easily be made "totally enclosed," we have two main types, one represented by the Sikorsky and Handley-Page biplanes, and the other by the Curtiss America type flying boat. Both the latter types are at a distinct advantage as regards "visibility," owing to the fact that they have two engines mounted out on the wings, where they do not greatly obstruct the view. This arrangement is not, however, economical except for large machines, and the inherent advantages of it will therefore scarcely be available for the small single seater or two-seater limousine of the future.

With regard to future development. It is always dangerous to venture to prophesy, more so, probably, in reference to matters aeronautical than in any other branch of science, but with due regard to such improvements as appear likely to be made in the way of engine and aeroplane efficiency, it may be possible to eliminate the types that appear least promising, and to indicate lines along which progress would appear to be most easily made.

It has already been stated that the ordinary tractor type with direct drive and having engine and air screw placed in front suffers from serious drawbacks owing to the obstruction formed by the comparatively large bulk of the engine directly in front of the occupants. It is possible that by somewhat re-designing this arrangement a serviceable machine of this type may be produced. For instance, take an enclosed biplane. If the engine is placed well down in the body and the seats of the occupants are situated fairly high in the body, say, for the sake of argument, so high that their heads are nearly touching the roof of the cabin, the resultant centre of gravity, especially if the tanks are also placed high, should not be so low as to render the machine difficult to handle. The Morane-Saulnier parasol monoplanes have already demonstrated that it is no serious drawback to have even a very low centre of gravity. The air screw could, by employing a suitable form of transmission—and this is a subject which, to our way of thinking, should be given the very greatest consideration since, up to the present, little has been done in this respect—be so placed as to coincide with the centre of resistance. The obstruction to visibility caused by a revolving propeller is comparatively unimportant, even when the engine is throttled down, as it would be when the machine was landing. Incidentally this arrangement, with the engine in front and low down, and the passengers to the rear of and above the engine, would be one of the safest imaginable in the case of a bad landing. A small, and by small we mean a single-seater or a two-seater, monoplane or biplane of this type would appear to be quite a reasonable proposition. The form of engine best suited for this purpose would probably be a vertical or Vee water-cooled, as this could be more easily hidden away in the lower part of the body than could any air-cooled engine, whether of the radial, rotary, or Vee type.

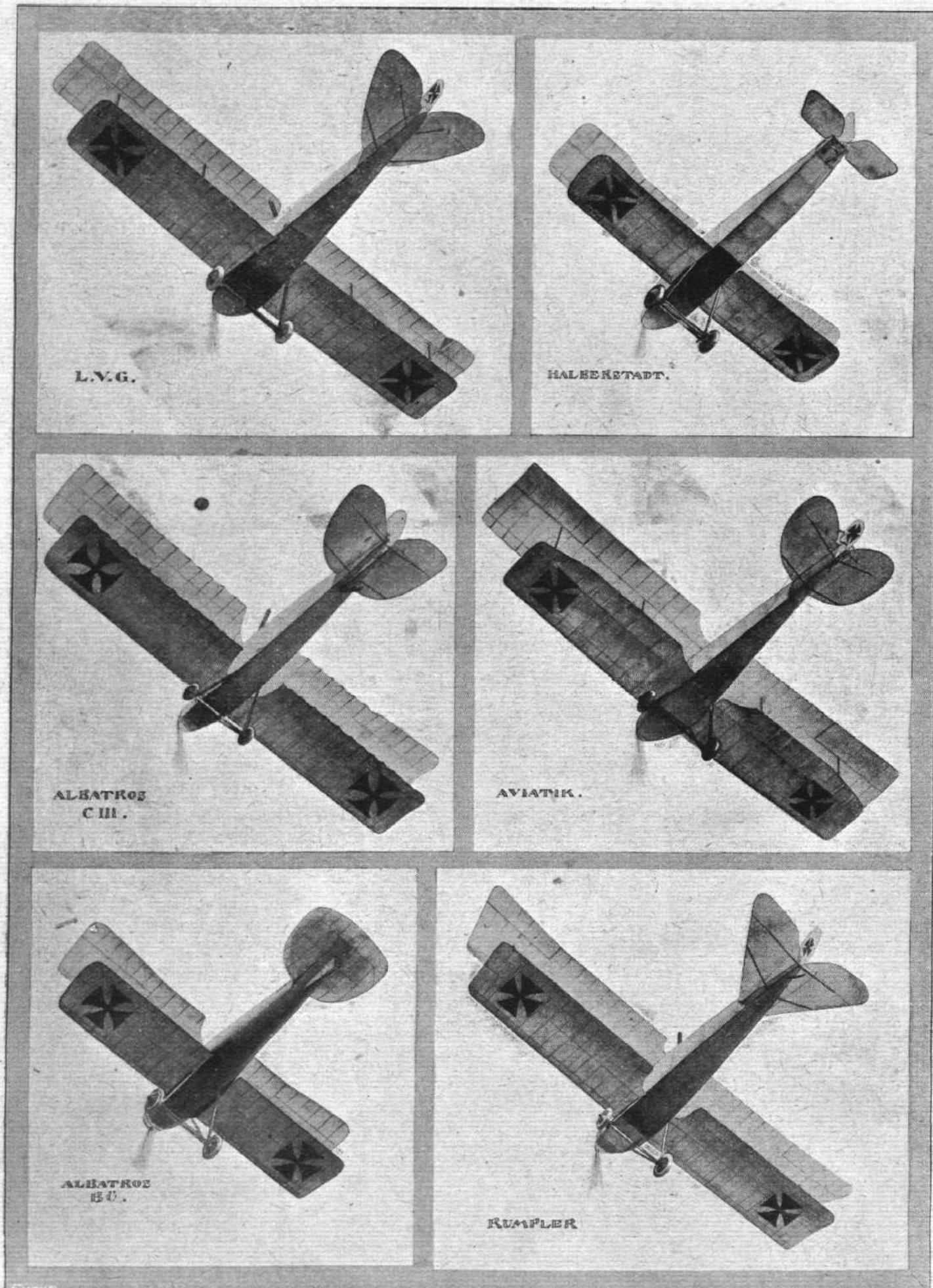
Another arrangement suitable for a small machine is that originated by the Curtiss firm with their Autoplane. From the point of view of visibility this arrangement is excellent, and with the engine in front and a long and necessarily fairly sturdy shaft running through the whole length of the cabin, it should be a very safe one in case of accidents. Although the Curtiss firm are fitting triplane wings to their machine, it does not necessarily follow that this is the only possible arrangement, although the triplane lends itself very well to it. It is conceivable that biplane, or even monoplane, wings could be employed. Until the Curtiss Autoplane has flown and one knows something about its behaviour in the air, it is difficult to form an opinion of the merits, aerodynamically speaking, of this arrangement, which is certainly very promising in other respects.

As we have already pointed out, the Blériot Aerocar is, so far, the only representative of the true "pusher" type of machine having both engine and air screw placed at the rear. A development of this type, which obviously suggests itself, is to employ biplane wings as in the ordinary "pusher" biplane, and to make the *nacelle* totally enclosed, the tail planes being carried on an outrigger in the usual way. By making the *nacelle* rounded in front, its sides gradually flattening out towards the rear, where it would terminate in a vertical knife edge of nearly the same length as the gap between the planes, the added side area in front should not make the machine spirally unstable, as the flat sides towards the rear would counteract the rounded side area of the nose. By fitting windows in the nose, sides, roof and floor of the cabin, a very good view could be obtained in all directions. Here again the engine would for preference be of the water-cooled type, as the cooling of an air-cooled motor at the rear might be attended with some difficulty in view of the shape of the rear of the *nacelle*. Unless objection is taken to having an engine behind one in the case of an accident, this arrangement would appear quite feasible, and, in practice, the "pusher" type without the totally enclosed *nacelle* does not seem to have proved so dangerous from this source as most people were inclined to imagine. Between the three types indicated above there should be ample scope for variety and originality, and developments are likely to be made with all of these.

We now come to deal with the large enclosed machine. Here the feature of enclosing will come as a matter of course, since this type of aeroplane will be used for flights of long duration, and already lends itself extremely well to closing in, on account of the fact that the engines are placed on the wings. There appears to be good reason to believe that, as the machines grow in size and carrying capacity, multiplanes will prove of advantage, and it will, in all probability, be along these lines that the large machines of the Handley-Page and Sikorsky type will develop. In the case of the flying boat it is less simple to fit multiplanes, as the position of the lower wing is limited in a downward direction, and any addition of wings will result in a low centre of gravity. For certain classes of work there does not appear to be any objection to providing the Handley-Page and Sikorsky type with floats so as to convert them into seaplanes, although the time is scarcely ripe to venture an opinion of the relative merits for open sea work of the seaplane and flying boat types.

It would thus appear probable that the transcontinental and transoceanic mail carrying aeroplanes of the future will be of the multi-engined and multiplane type, since the employment of several engines tends to make for greater reliability and more than two pairs of superimposed wings are structurally economical, especially for very large machines. Already existing machines form a very good basis to work upon, and the long-distance aeroplane is held by many authorities to be a mechanical possibility at the present time.

That the enclosed aeroplane will have to come cannot be doubted, not only because in the future flights of much longer duration than are common at present will be made, but also because for comfortable flying—apart, of course, from racing and other flying sports, for which the open type will still be employed in order to get better performance—it is not very enjoyable to sit with one's nose in a draught of anything from 70 to 100 m.p.h. Manufacturers are at present too busily engaged on meeting the more immediate demands of the flying services for war purposes, but when peace shall again reign there will be enormous development in sporting and commercial aeronautics, and the manufacturer who is farsighted enough to realise its possibilities will lose no time in getting his drawing office staff to work on the development of the peace time machine.



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The Identification of German Aeroplanes. Plate V.

(See also page 475.)

IDENTIFICATION OF GERMAN AEROPLANES.

(COPYRIGHT.)

(Continued from page 445.)

In our last issue we published sketches of six different German aeroplanes, all shown from the same point of view, *i.e.*, three-quarter front from above. This week the series is continued with the same machines from a different point of view. The reason for illustrating the various machines all in the same attitude is, as was pointed out last week, that by so doing comparison is facilitated. Later on, when the machines have been illustrated in what appears to us to be a sufficient number of attitudes we may collate the different sets in groups showing each machine in its different attitudes, thereby illustrating, not so much the differences between the various machines, but all the special features of each.

The view published this week, which represents the machines as they would appear when passing overhead—by holding the page of illustrations at arm's length above one's head the correct impression is most easily obtained—gives a very good idea of the proportions

of the machines, and as it is, perhaps, the view most frequently obtained in practice, it will, it is hoped, prove especially useful for identification purposes.

For the other peculiarities not visible in this view we would refer our readers to the text accompanying previous sets of illustrations on page 368, 393, 415, and 445.

The following table gives the approximate dimensions of the various machines:—

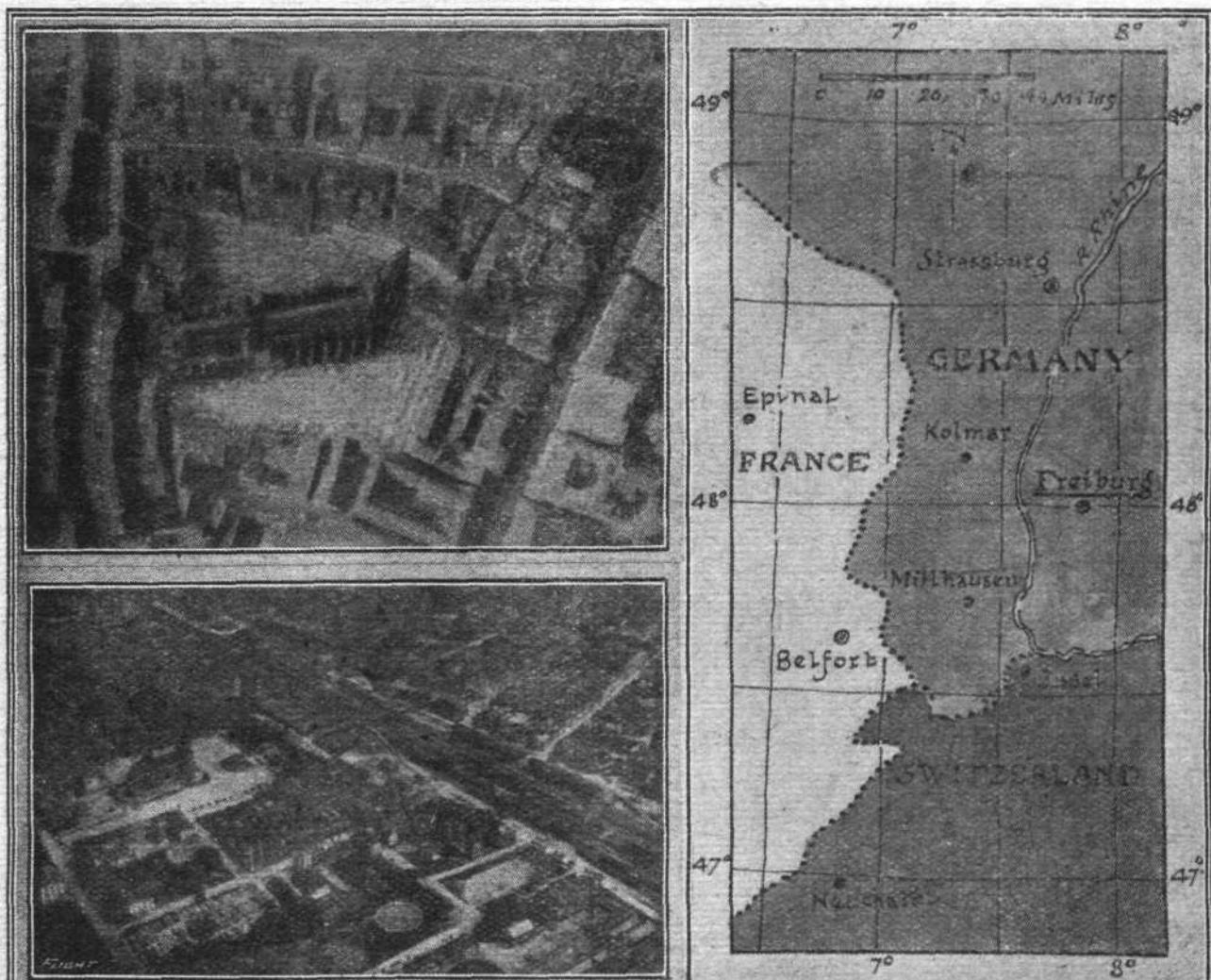
Name of Machine.	Span.				Length ft. in.
	Top. ft. in.	Bot. ft. in.	Gap. ft. in.	Chord. ft. in.	
Albatros C. III..	39 2	37 3	5 3	6 1	26 4
Albatros Bü..	28 4	26 9	5 3	5 9	24 0
Aviatik..	41 0	35 4	6 4	6 1	26 3
Halberstadt ..	28 6	26 0	4 6	5 0	24 0
L.V.G. ..	42 10	37 10	5 6	5 10	27 0
Rumpler ..	40 10	36 10	5 9	5 6	26 4

Germans and Reprisals.

A SEMI-OFFICIAL message sent out from Berlin on Saturday states:—

"A new camp for officer prisoners has been established at Freiburg in Breisgau. The transfer of British and French officers of all ranks to this new camp was begun to-day. These officer prisoners will be housed in various hotels in the town."

An official telegram sent out from Berlin earlier in the week stated that, as a reprisal for the placing of a German general and 15 staff officers on French hospital ships in the Mediterranean, the German authorities have placed thrice this number of French officers of corresponding ranks at points in the western industrial district which are especially subject to aerial attacks.



FROM ABOVE.—The German town Freiburg in Breisgau, which was bombed recently by way of a reprisal for the sinking by the Germans of British hospital ships. The pictures, which were taken from an aeroplane, show: Top, the western part of the town, and bottom, the cathedral. The map gives a good idea of the location of Freiburg.

THE ROLL OF HONOUR.

REPORTED by the Admiralty:—

Killed.

Flight Sub-Lieut. Douglas E. Penney, R.N.

Drowned.

Flight-Lieut. John C. Railton, R.N.

Flight Sub-Lieut. Robert S. Wigham, R.N.

Accidentally Killed.

Flight-Lieut. (Actg. Sub-Lieut., R.N.R.) Lewis Morgan, R.N.

Prob. Flight Officer Randolph H. Seed, R.N.

Missing, believed Killed.

Midshipman John Barber, R.N.R.

Previously reported Drowned, now reported Not Drowned.

Lieut. William C. A. Meade, R.N.V.R.

Flight Sub-Lieut. Guy D. Smith, R.N.

Wounded.

Flight Sub-Lieut. Hubert S. Broad, R.N.

Flight Sub-Lieut. Edward D. Crundall, R.N.

Flight Sub-Lieut. Oliver J. Gagnier, R.N.

Flight Sub-Lieut. Lea E. B. Wimbush, R.N.

Lieut.-Com. Eric F. Wood, R.N.V.R.

Accidentally Injured.

Flight Sub-Lieut. Arthur E. Hall, R.N.

Flight Sub-Lieut. Leonard G. Steel, R.N.

Missing.

Flight Sub-Lieut. John B. Daniell, R.N.

Flight-Lieut. Charles J. Moir, R.N.

Flight Sub-Lieut. Harry S. Murton, R.N.

Previously reported Missing, now reported Prisoner of War.

Flight Sub-Lieut. Neville D. M. Hewitt, R.N.

Reported by the War Office:—

Killed.

2nd Lieut. A. Bonner, S. Staffs., attd. R.F.C.

Lieut. C. J. Bruce, Can. F.A., attd. R.F.C.

2nd Lieut. R. B. Davies, N'land F. and R.F.C.

Lieut. B. L. Franklin, Middlesex, attd. R.F.C.

Lieut. J. C. Hartney, Manitoba, attd. R.F.C.

2nd Lieut. B. King, K.O. (Yorks. L.I.) and R.F.C.

Lieut. H. L. Lomer, R.F.C.

2nd Lieut. E. P. Morris, Buffs (E. Kent) and R.F.C.

2nd Lieut. M. J. Morris, R.F.C.

Lieut. H. C. Patterson, Bedfords, attd. R.F.C.

Lieut. C. L. Pickering, Cheshire and R.F.C.

2nd Lieut. A. W. Watson, R.F.C.

2316 CorpL W. Hodgson, R.F.C.

Previously reported Missing, now reported Killed.

2nd Lieut. R. G. R. Allen, W. Yorks and R.F.C.

2nd Lieut. J. P. C. Mitchell, Highland L.I., attd. R.F.C.

2nd Lieut. N. R. Pomeroy, R.F.C.

Capt. A. S. M. Summers, Hussars, attd. R.F.C.

2nd Lieut. E. A. Welch, R.F.C.

Died of Wounds.

2nd Lieut. R. B. Cooper, R.F.C.

2nd Lieut. C. J. Pile, R.F.A., attd. R.F.C.

2nd Lieut. W. K. Trollope, R.F.C.

Previously reported Wounded, now reported Died of Wounds.

2nd Lieut. F. S. Andrews, R.F.C.

2nd Lieut. R. B. Clarke, R.F.C.

2nd Lieut. F. St. V. Morris, Sher. For., attd. R.F.C.

Died.

1313 Pilot T. M. Allen, Aust. Flying Corps.

33404 2nd Air-Mech. H. Cole, R.F.C.

62928 2nd Air-Mech. W. Prior, R.F.C.

Missing, believed Killed.

Lieut. G. A. Radcliffe, A. and S. Hrs., attd. R.F.C.

Wounded.

2nd Lieut. R. K. Abram, A. and S. Hrs., and R.F.C.

Lieut. D. H. Bell, M.C., Cam. Hrs., attd. R.F.C.

Capt. C. J. Q. Brand, M.C., R.F.C.

Lieut. W. Bruce, King's (L'pool.), attd. R.F.C.

Lieut. C. J. Cleaver, M.C., R.F.C.

Lieut. J. T. Collier, R.F.C.

2nd Lieut. H. M. Coombs, R.F.A. and R.F.C.

2nd Lieut. R. G. Dalziel, R.F.C.

Lieut. T. F. Davis, E. Surrey, attd. R.F.C.

Lieut. F. E. Elliott, R.G.A., attd. R.F.C.

2nd Lieut. C. H. P. Ewbank, R.F.C.

2nd Lieut. L. G. Fauvel, R.F.C.

2nd Lieut. H. E. R. Fitchat, R.F.C.

Lieut. J. R. Geddes, Can. Gen. List, attd. R.F.C.

2nd Lieut. L. G. Harrison, R.F.C.

2nd Lieut. C. C. Knight, Dorset and R.F.C.

2nd Lieut. P. S. Laughton, N. Staffs, attd. R.F.C.

Lieut. E. G. Leake, Manchester and R.F.C.

2nd Lieut. A. J. Lucas, R.F.C.

Lieut. A. A. J. MacIver, Alberta, attd. R.F.C.

Capt. F. S. Moller, M.C., R.F.C.

2nd Lieut. E. C. H. Nicholls, Queen's (R.W. Surrey) and R.F.C.

Capt. R. Oxspring, M.C., K.O. (Yorks. L.I.), attd. R.F.C.

2nd Lieut. E. O. Perry, Sher. For. and R.F.C.

Lieut. T. G. Poland, E. Surrey and R.F.C.

2nd Lieut. C. S. Ramsey, R.E. and R.F.C.

Lieut. R. A. Redfern, R.F.C.

2nd Lieut. H. L. E. Richards, R. Welsh F., attd. R.F.C.

2nd Lieut. H. G. Ross, R.E. and R.F.C.

Capt. D. W. Rutherford, Aus. Inf. and R.F.C.

2nd Lieut. A. C. Sanderson, R.F.C.

Lieut. E. L. Sellars, Manchester and R.F.C.

2nd Lieut. S. J. Stewart, R.F.C.

Lieut. E. H. Stuart, Cyclist Batt. and R.F.C.

Lieut. E. A. Thomas, R.F.A. and R.F.C.

2nd Lieut. C. J. Thompson, R.F.C.

2nd Lieut. J. F. Turner, Cheshire and R.F.C.

2nd Lieut. H. E. R. Twamley, Sher. For., attd. R.F.C.

2nd Lieut. F. S. Wallis, R.F.C.

2125 Sergt. J. V. Bell, R.F.C.

65247 2nd Air-Mech. H. M. Peirson, R.F.C.

Missing.

2nd Lieut. V. H. Adams, R.F.C.

2nd Lieut. L. G. Bacon, R.F.C.

Capt. F. L. Barwell, London and R.F.C.

Capt. S. F. Browning, R.F.C.

2nd Lieut. V. L. A. Burns, R.F.A. and R.F.C.

2nd Lieut. C. C. Cheate, R.F.C.

Lieut. J. C. G. Coupland, R.F.A., attd. R.F.C.

Capt. D. A. L. Davidson, M.C., R.F.C.

2nd Lieut. J. E. Davies, London and R.F.C.

2nd Lieut. E. L. Edwards, Welsh, attd. R.F.C.

2nd Lieut. A. E. Fereman, Middlesex, attd. R.F.C.

2nd Lieut. A. Fraser, R.F.C.

2nd Lieut. R. P. C. Freemantle, R.F.C.

Lieut. G. S. French, Cambridge, and R.F.C.

Lieut. G. P. Harding, M.C., Cheshire, attd. R.F.C.

2nd Lieut. E. W. A. Hunt, R.F.C.

Lieut. G. D. Hunter, Central Ontario, attd. R.F.C.

2nd Lieut. N. A. Lawrence, R. Fus., attd. R.F.C.

2nd Lieut. D. Mactavish, Cameron Hdr., and R.F.C.

Lieut. C. R. O'Brien, K.O. (R. Lancs.) and R.F.C.

Lieut. D. K. Paris, R.F.A. and R.F.C.

2nd Lieut. J. L. Pinson, S. Staffs., attd. R.F.C.

2nd Lieut. H. J. Price, Queen's (R.W. Surrey), attd. R.F.C.

2nd Lieut. C. Reece, Cheshire and R.F.C.

2nd Lieut. P. Sherman, R.F.C.

2nd Lieut. F. Stedman, I.A. Res. of Off., attd. R.F.C.

2nd Lieut. G. R. Y. Stout, A. and S. Hdr., and R.F.C.

2nd Lieut. R. H. Upson, Queen's (R. W. Surrey) and R.F.C.

Previously reported Missing, now reported Prisoners of War in German hands.

2nd Lieut. J. Vairbairn, R.F.C.

2nd Lieut. F. E. Hills, R.G.A. and R.F.C.

2nd Lieut. W. B. Hills, Hampshire and R.F.C.

2nd Lieut. M. J. J. G. Mare-Montembault, Yeo, and R.F.C.

2nd Lieut. S. S. B. Purves, Yeo, and R.F.C.

**Captain Ball, D.S.O., M.C., Missing.**

CAPTAIN ALBERT BALL, D.S.O., M.C., R.F.C., who is credited with having brought down 42 German machines, has been missing since the evening of May 7th. He ascended

with 10 others, and at 8 o'clock he was observed not far over the enemy lines, flying perfectly; the light was then failing and he was not seen subsequently. According to one report he is a prisoner in German hands and in hospital wounded.

THE BOMBING OF A DUTCH TOWN.

EXHAUSTIVE enquiries made by the Government have, it is stated, proved conclusively that it is out of the question that the bombs dropped on the Dutch town of Zierikzee on April 29th-30th could have been dropped by any British aircraft.

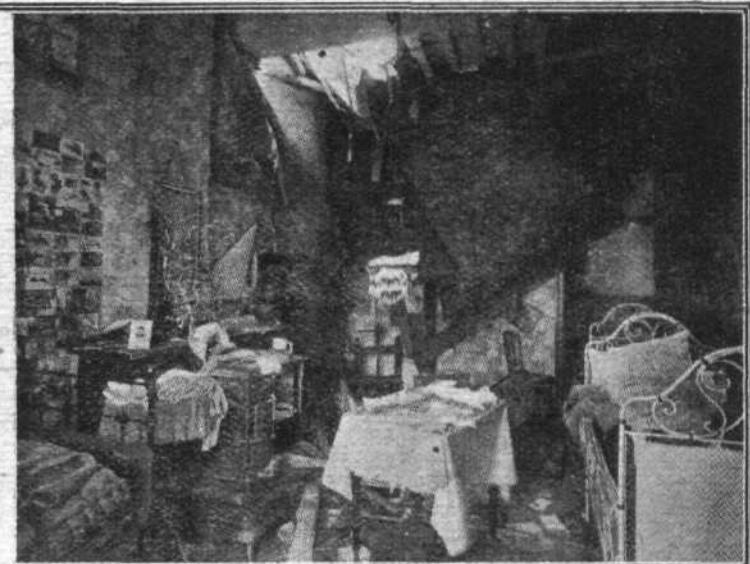
The only British aircraft which might conceivably have been concerned were two naval aeroplanes which left the vicinity of Dunkirk on the night in question in order to attack Zeebrugge mole, over which they dropped 16 bombs. Both machines took the same time, within 14 minutes of each other, to reach their objective and return to their base. Both were slow machines, and there was an adverse north-east wind of about 20 m.p.h. velocity. The time taken by both to carry out the attack on Zeebrugge and to return

be recognised probably as British in imitations of British marks; others cannot be identified, and have no resemblance whatever to any known British markings. The Government have informed the Netherlands Government to this effect.

It is worthy of note:—

(1) That on the night of May 3rd-4th British aeroplanes operating near the Belgian coast reported having observed an aeroplane (presumably enemy) near La Panne, which was carrying a powerful light.

(2) That in November last a false statement that British aircraft had dropped bombs at Rheinfelden, in Swiss territory, was published by the *Strassburger Post*. It was affirmed that the bombs were of British manufacture. It happened, however, that no damage was done, and no recognisable frag-



By courtesy of "Het Vliegveld."

Some views of the destruction brought about by a bombing aeroplane's destructive visit to Zierikzee, Holland.

makes it quite impossible that either of them could have got so far east as Zierikzee, even had it been possible that their pilots could have mistaken the well-known objective of Zeebrugge.

Each machine carried eight bombs. A German *communiqué*, issued later and reproduced in the Dutch Press, stated that on this night 15 bombs were dropped by British aircraft and fell into the water in proximity to German naval vessels at Zeebrugge. Neither of the British machines carried any searchlights, star shells, or other ground-illuminating apparatus. The machine which bombed Zierikzee is reported to have operated with searchlights.

As regards the marking of the parts of bombs picked up by the Dutch authorities at Zierikzee, certain markings can

ments were picked up, and consequently the purpose of the German Government (which was no doubt to embroil Great Britain and Switzerland) was not effected. Shortly before that occurrence the Germans had captured a British aeroplane carrying bombs.

(3) That German aircraft of all descriptions have repeatedly and for many months manœuvred over Dutch territory, and on at least one occasion dropped objects on to Dutch territory.

(4) That the armed forces of the German Government have shown little, if any, respect for the lives or property of neutrals, as is universally proved by the deliberate sinking of neutral vessels of all nationalities and the murder of defenceless neutral subjects.



while flying an aeroplane at an aerodrome in Yorkshire on May 12th. The machine fell, and he was picked up in an unconscious condition, and conveyed to military hospital, death taking place on the way there.

An officer attached to the R.F.C. was killed whilst flying over Hounslow Heath on May 13th. Whilst engaged in manœuvring about 6 o'clock he was observed to be in difficulties, and the machine crashed to the earth. When the officer was picked up life was found to be extinct.

Whilst testing a new biplane at Roundhay, Leeds, on May 12th, Mr. W. Rowland Ding was killed. According to reports the machine was looping the loop when the wings collapsed. The machine fell to the ground and burst into flames.

A Fatality in America.

ONE of the best-known of American pilots, Victor Carlstrom, and an Army pupil, were killed at Newport News, Virginia, on May 9th, their machine collapsing at a height of 3,500 ft.

A Fatality in Japan.

LIEUT. SHIYU SAWADA, of the Japanese Army, was killed at Tokorozawa on March 8th. He had only returned on February 25th from France, where he had been for six months studying military aviation at the Maurice Farman school.

Fatal Accidents.

A VERDICT of "Accidental Death" was returned at an inquest on May 7th on 2nd Lieut. Trollope and 2nd Lieut. Cauldwell, who were killed while flying on May 4th. The former, a qualified aviator, had charge of the machine, the engine of which is stated to have failed.

A similar verdict was returned at the inquest on Cadet G. V. Smirnov, a Russian, and Capt. Lylewain, R.F.C., who were killed in a flying accident. The machine fell from about 200 ft., and upon contact with the ground the petrol tank burst and the machine was enveloped in flames. Captain Lylewain was killed instantaneously, and the cadet died a few hours later at the Southall military hospital from syncope.

Lieut. Peter Orme, R.F.C., died in the Military Hospital at Brighton on May 7th as the result of an accident while riding a motor-cycle near Horsham earlier in the day.

Lieut. L. E. Baker, while flying in Yorkshire, got into difficulties on a left-hand turn when about 700 ft. up. His machine nose-dived to earth and he was killed instantly.

Flight-Lieut. L. Morgan, R.N. and Prob. Flight Officer H. Seed were killed near Edmonton on May 11th. They were flying at a height of about 5,000 ft. when apparently something went wrong with the engine and the machine nose-dived to the ground.

2nd Lieut. A. D. Merchant, R.F.C., met with fatal injuries

"THE NAVY-THAT-FLIES."

I.

THE Royal Naval Air Service found itself "over the other side" about the time that the shells of the British monitors began feeling for the hidden batteries of the Boche behind the Belgian coast.

"I can't see where they're pitching," said the Navy-that-Floats, referring to the shells of the monitors bursting 12 miles away. "What about spotting for us, old son?"

"That will I do," replied the Navy-that-Flies. "And more also. But I shall have to wear khaki, because it's done out here; by everybody, apparently. Even the newspaper reporters wear khaki. Also I must have the right machines, and lots of 'em."

"Wear anything you like," replied the Navy-that-Floats, "as long as you help us to hit these shore batteries. Only—because you wear khaki and see life, don't forget you're still the same old Navy as it was in the beginning, is now, and ever shall be."

The Navy-that-Flies added "Amen," and said that it wouldn't forget. It garbed itself in khaki, but retained the ring and curl on the sleeve, and the naval cap (with the eagle's wings in place of the crown and anchor in the badge), plus a khaki cap-cover. Wherever its squadrons were based they rigged a flagstaff and flew the White Ensign at the peak. They erected wooden huts and painted them Service grey, labelling them "Mess-deck," "Wardroom," "Gun-room," &c., as the case might be:

They divided the flights into port and starboard watches, and solemnly asked leave to "go ashore" for recreation. Those who strayed from the same stern pathos of discipline suffered the same punishments as the Navy-that-Floats. And at the conclusion of each day's work the Wardroom dined, and drank to their King, sitting, according to the custom and tradition of the naval service.

They filled in shell-holes and levelled the ground for aerodromes; they ran up hangars and excavated dug-outs—whither they retired in a strong silent rush (the expression is theirs) when the apprehensive Boche attempted to curtail their activity with bombs.

And by degrees the right machines came along. The Navy-that-Flies swung itself into them critically, flung them about in the air three miles high, testing and measuring their capabilities. Then they fought them, crashed them, improved on them, till they were righter still, and finally proceeded (to quote another of their expressions) to "put the wind up Old Man Boche" in a way that helped the Navy-that-Floats enormously.

But apart from spotting duties, which were necessarily intermittent, the R.N.A.S. undertook a photographic reconnaissance of the entire Belgian coast from Nieuport to the Dutch frontier. The work in progress at Ostend and Zeebrugge, the activities of submarines and destroyers inside the basins: locks, quays, and gun-emplacements, and the results of bombs dropped thereon the night before, were all faithfully recorded by these aerial cameras. The negatives were developed and printed, the resultant bird-pictures enlarged, studied through stereoscopic lenses, and finally given to the monitors "for information and guidance." Since it is not given to every one to recognise the entrance to a dug-out or a group of searchlights as they appear from a height of 20,000 ft., the photographs were embellished with explanatory notes for the benefit of anyone unaccustomed to such unfamiliar aspects of creation.

The Germans claim to be a modest people. They were as busy as beavers, and they resented these importunate photographers with all the fervour that springs from true modesty. Their anti-aircraft guns plastered the intruders with bursting shrapnel, and from every coast aerodrome Boche machines rose like a crowd of angry hornets to give battle. Yet day after day fresh plates find their way to the developing trays, and a comparison between the official reports of the fights—couched in a laconic terseness of phrase that is good to read—and the amazing results obtained, gives perhaps the truest measure of the work performed by these very gallant gentlemen.

Not a spadeful of earth can be turned over, nor a trowel of cement added to a bastion along the coast, but a note appears a day or two later upon the long chart which adorns the record

office of this particular squadron. A crumpled escorting machine may have come down out of the clouds, eddying like a withered leaf, to crash somewhere behind the German lines; there may be somewhere near the shore a broken boy in goggles and leather lying amid the wreckage of his last flight. Such is the price paid for a few more dots added in red ink to a couple of feet of chart. But as long as the photographic machine returns with the camera intact the price is paid ungrudgingly.

The work of these photographic recorders, pilot and observer alike, differs from all other forms of war flying. Their sole duty is to take photographs not haphazard, but of a given objective. This necessitates steering a perfectly steady course, regardless of all distractions, such as bursting "Archies" and angry "Albatros" fighters. They leave the fighting to their escorts and their fate to Providence. The observer, peering earthwards through his view-finder, steers the pilot by means of reins until he sights the line on which the desired series of photographs are to be taken; once over this, the pilot flies the machine on an undeviating course, and the observer proceeds to take photographs. When all the plates have been exposed they turn round and return home, with what remain of the escort. On occasions the escort have vanished, either earthwards or in savage pursuit of resentful though faint-hearted Boches; this is when the homing photographer's moments are apt to become crowded with incident.

One such adventure deserves to be recorded. It happened about 12,000 ft. above mother earth; the official report, typed in triplicate, covered some dozen lines, the actual events an equal number of minutes, but the story is one that should live through eternity.

"While exposing six plates" (says the official report of this youthful recording angel) "observed five H.A.'s cruising." (H.A. stands for hostile aeroplane.) "Not having seen escort since turning inland, pilot prepared to return. Enemy separated, one taking up position above tail and one ahead. The other three glided towards us on port side" (observe the Navy speaking), "firing as they came."

"The two diving machines fired over 100 rounds, hitting pilot in shoulder." As a matter of sober fact, the bullet entered his shoulder from above and behind, breaking his left collar-bone, and emerged just above his heart, tearing a jagged rent down his breast. Both his feet were furthermore pierced by bullets, but the observer was not concerned with petty detail.

"Observer held fire until H.A. diving on tail was within five yards."

Here it might be mentioned that the machines were hurtling through space at a speed in the region of 100 miles an hour. The pilot of the "H.A." having swooped to within speaking distance, pushed up his goggles and laughed triumphantly, as he took his sight for the shot that was to end the fight. But the observer had his own idea of how the fight should end.

"Then shot one tray into pilot's face," he says with curt relish, and watched him stall, sideslip, and go spinning earthward in a trail of smoke.

He then turned his attention to his own pilot. The British machine was barely under control, but as the observer rose in his seat to investigate the foremost gun fired, and the aggressor ahead went out of control, and dived nose first in helpless spirals. Suspecting that his mate was badly wounded, in spite of this achievement, the observer swung one leg over the side of the fuselage and climbed out on to the wing—figure for a moment the air-pressure on his body during this gymnastic feat—until he was beside the pilot, who, faint and drenched with blood, had nevertheless got his machine back into complete control.

"Get back, you ass!" he said through white lips, in response to enquiries as to how he felt. The ass got back, the way he came, and looked round for the remainder of the "H.A.'s." These, however, appeared to have lost stomach for further fighting, and fled. The riddled machine returned home at 100 knots, while the observer, having nothing better to do, continued to take photographs. "The pilot, though wounded, make a perfect landing." Thus the report concludes.

**Dutch Recognise a Brave Deed.**

A SUBSCRIPTION is being got up, states the *Gazette de Hollande*, for the purpose of presenting a testimonial to the British aviator, Lieut. Morrell, who, at the imminent risk of

his life, dived into the sea from the pier at Scheveningen last Sunday and saved a Dutchman from drowning. The British Minister at The Hague has consented to make the presentation.

AVIATION IN PARLIAMENT.

Mr. Bonar Law's Tribute to the Flying Services.

In his speech introducing the supplementary vote of credit on May 9th, Mr. Bonar Law, referring to the recent fighting on the Western Front said : " As regards the effectiveness of this fighting, I think it is a gratifying thing to feel that a very large part of the success was due to our superiority in artillery. When the House realises that before the War it would have been supposed—at least I think so—the most difficult branch of the Service to train rapidly, considering how absolutely destitute we were in munitions of war as compared with our enemy, it is indeed something of which as a nation we have a right to be proud, that in this branch of fighting we have a distinct superiority over our enemy—a superiority which shows in another direction. It is shown by our airmen who are the eyes of our long-range guns. I have been told more than once that in France it is not uncommon to find regiments show their admiration for our airmen by cheering one of them as he flies low over their lines. That to me is not surprising. These men are all young—many of them are little more than boys—but from the beginning of this War they have shown a dash, a courage, a nerve and a resourcefulness which entitles us to say that a more glorious fighting force has never existed in the world."

R.N.A.S. and U Boats.

In the official report of the secret session of the House of Commons, on May 11th, it is stated that Sir Edward Carson, First Lord of the Admiralty, "gave information about the activity of the Admiralty in the organisation of anti-submarine warfare, the co-operation of the Naval Air Service with the coast patrols."

Reports of R.F.C. Work.

MR. GEORGE TERRELL, in the House of Commons, on May 8th, asked the Under-Secretary of State for War whether, in view of the heroism displayed by the members of the Royal Flying Corps, he will arrange for reports of aerial engagements to be published in greater detail, together with the names of the officers and men distinguishing themselves therein ?

Mr. Macpherson : The reports of combats in the air are supplied by the officers and men who have been engaged in them, and are remarkable for their brevity. When such actions are considered by the Commander-in-Chief to be worthy of rewards, short accounts are published, and it would be difficult to amplify those. With regard to the second part of the question, I may remind my hon. friend that, as pointed out in a reply given by the Financial Secretary to the War Office on July 13th, 1916, those actions which appeal to the public are not necessarily most commendable, and only the Commander-in-Chief is in a position to judge in what cases the names of those participating should be made public. It was, and, I believe, still is, the expressed desire of the officers of the Royal Flying Corps that no mention of individual names should be made.

Mr. Terrell : Does the hon. gentleman consider that the reports as published are the best and most descriptive which can be supplied, and does he think that the suppression of the names of the gallant men who take part in these engagements serves any useful military purpose?

Sir Henry Dalziel : Is the hon. gentleman aware that a young lieutenant of twenty years of age has recently brought down forty enemy machines, that he has been personally congratulated by Sir Douglas Haig, and yet his name is not allowed to be mentioned?

Mr. Terrell : In view of the unsatisfactory reply to my question, I beg to give notice that I shall raise this matter on the Motion for the Adjournment to-morrow.

Hours of R.F.C. Mechanics at Hounslow.

MR. TYSON WILSON asked the Under-Secretary for War if he is aware that the men in the 18th wing aeroplane repair section at Hounslow Heath are working from 5.45 a.m. to 9 p.m. seven days per week; that on a recent Sunday they asked for leave from 5 p.m. to midnight, but were only granted from 8 p.m.; if he is aware that there are a number of men in repair sections who are not working on repairs; that there is machinery standing idle which, if utilised, would considerably reduce the manual labour required; and whether he will utilise this machinery and also the men who are not fully employed, with the object of reducing the long hours now worked by the men in the 18th wing aeroplane repair section?

Mr. Macpherson : The normal working hours are from 8 a.m. to 5 p.m., which may, of course, be extended on pressure of work. I am informed that on no occasion has an application for leave, such as is mentioned in the second part of the question, been made. Some of the work undertaken cannot be described as repairs, but it is all undertaken in the best interests of the service. The machinery referred to in the last part of the question is in process of erection, and is not yet ready; every man is fully employed, and the work is evenly distributed.

Mr. Wilson : Is the hon. gentleman quite certain that his information is correct?

Mr. Macpherson : Yes, I am.

Freiburg Air Raid Leaflet.

SIR W. COLLINS asked the Under-Secretary of State for War if he will state the contents of the leaflets dropped in Freiburg by the air squadron which conducted the recent reprisal on that town?

Dr. Macnamara : My hon. friend has asked me to reply to this question. The contents of the leaflets were as follows, in German :

"As reprisal for the sinking of the hospital ship 'Asturias,' which took place on the 20th-21st March, 1917."

R.F.C. Casualties.

MR. BILLING, on May 9th, asked the Under-Secretary of State for War whether the reported losses of men and machines in the Royal Flying Corps include losses sustained by action or accident over our lines; and, if not, what is the number of such losses for the months of April and March?

Mr. Macpherson : All casualties in the Royal Flying Corps in the various theatres of operations are published in the casualty lists.

R.N.A.S. Work at the Front.

MR. BILLING asked the Under-Secretary of State for War whether, in the recent singularly successful air battle, out of the 40 enemy aeroplanes which the military communiqué stated were shot down, 29 were brought down by a squadron of the Royal Naval Air Service attached to the Royal Flying Corps in France; and whether, under these circumstances, he will arrange that in future communiqués praise shall fall where praise is due?

Mr. Macpherson : Complete information is not provided by the military authorities in France as to the particular squadrons, which inflict casualties on the enemy. I can assure the House that the valuable services of the naval contingent serving with the Royal Flying Corps in France are fully recognised.

Anti-Aircraft Insurance.

SIR HAROLD ELVERSTON, on May 10th, asked the President of the Board of Trade the total of the anti-aircraft insurance premiums received during the first year of the existence of the Government scheme of insurance; and what was the total amount of the claims paid during the same period?

Mr. Roberts : I do not think it would be desirable to publish the figures relating to any of the Government insurance schemes at present.

Sir H. Elverston : Can the hon. gentleman say what is the percentage of losses?

Mr. Roberts : That is what I said it would be inexpedient to give. If there is any other point I shall be glad to consider it.

Reprisals.

COLONEL C. LOWTHER asked the Prime Minister whether, in view of the peril of Laon Cathedral and other historic monuments, he will appoint a small Committee to consider the introduction of special and specific punishment for further flagrant acts of vandalism upon the historic buildings of the world?

Mr. Bonar Law : I do not think that the suggestion of my hon. and gallant friend would be likely to obtain the result he desires.

Colonel Lowther : As the Government seem to be averse to setting on fire historic buildings in Germany, will they consider the possibility seriously of bombing and setting on fire the Black Forest?

Mr. Bonar Law : I doubt whether that would have the effect which my hon. friend anticipates.

Mr. Billing : Are we to understand that all idea of reprisals has been definitely abandoned?

Mr. Joynson-Hicks asked the Prime Minister whether, since the Freiburg reprisal raid, two further hospital ships have been torpedoed and a German aeroplane has killed civilians in London; and, if so, whether the Government proposes to take instant and severe reprisals for these acts?

Mr. Bonar Law : The answer to the first part of the question is in the affirmative. With regard to the second part, I cannot at present make any statement.

Air Raids (Compensation).

MR. GILBERT asked the Prime Minister whether he is aware that last September a tramway motor-man and conductor, in the employ of the London County Council, were killed while at work in South London by bombs dropped from enemy aircraft; that the council has been advised that they cannot compensate these men's families under the Workmen's Compensation Act or under Section 44 of the London County Council (General Powers) Act of 1895; and, as one man has left a widow with five young children totally unprovided for and as there is no insurance scheme provided by the Government for life risks against aircraft bombs, if he will consider whether compensation should be paid to the families of these two men killed by enemy acts out of public funds?

Mr. Bonar Law : No Government insurance scheme for personal injury or loss of life from aircraft has been set up as none was thought necessary in view of existing facilities for life insurance. I understand that the National Relief Fund gives temporary assistance in necessitous cases. I am not aware whether it is in the power of the London County Council to assist from funds at its disposal.

The R.N.A.S. and the German Submarine Menace.

MR. BILLING asked the First Lord of the Admiralty whether he will take an early opportunity of expressing his appreciation of the work that is being accomplished by a section of the Royal Naval Air Service in reducing the submarine peril in home waters; whether the greater the support and sympathy displayed by the senior naval officers in the work of the Royal Naval Air Service the greater is the measure of success achieved in that district; and, if so, whether he will impress on all senior naval officers the value of keeping their seaplane squadrons well posted with the latest information available of movements and sinkings?

Dr. Macnamara : The good work accomplished by the Royal Naval Air Service in locating and hunting enemy submarines is fully appreciated by the Admiralty, and receives frequent recognition. Full use is made of the seaplane squadrons by the senior naval officers in the various areas, and close co-operation with the patrol flotillas maintained.

R.N.A.S. Attack on an Enemy Destroyer.

MR. BILLING asked the First Lord of the Admiralty whether an enemy destroyer has been recently attacked by a machine of the Royal Naval Air Service; and, if so, whether this attack was successful, and to what extent?

Dr. Macnamara : Yes, Sir! The facts were made public in the official Admiralty communiqué of April 24th.

Seaplanes.

COLONEL C. LOWTHER asked the Secretary to the Admiralty whether the British Navy is supplied with seaplanes capable of discharging torpedoes; and whether this method of offence has been practised with success against the enemy's shipping?

Dr. Macnamara : Yes, Sir. This method of attack was first employed with success in August, 1915, by Royal Naval Air Service pilots, who sank several enemy supply ships in the Dardanelles.

Report of Enemy Losses.

MR. BILLING asked the Under-Secretary of State for War whether all the enemy machines reported as driven down out of control landed behind our lines; and, if not, what evidence the authorities have to prove that the same were out of control or that the enemy suffered the loss of either man or machine, and, if there is such evidence, why the authorities distinguish between shot down and driven down?

Mr. Macpherson : I understand that the distinction is made between those machines which after falling are seen to crash, and those whose actual impact with the ground is not seen, although they were manifestly out of control when falling.

The Training of Pilots.

MR. BILLING asked the Under-Secretary of State for War whether he is aware that the losses sustained by the Royal Flying Corps in training of pilots is proportionately more than double those sustained by the Royal Naval Air Service; whether he is aware of the principle and method employed; and, if not, having regard to the proved greater efficiency in training of the Royal Naval Air Service, he will approach the Air Lord with a view to inviting his advice and assistance in this connection?

Mr. Macpherson : The answer to the first part is in the negative, to the second in the affirmative, and to the third that the officers responsible for training in the two Services are in close touch.

Board of Invention and Research.

MR. MACMASTER, on May 14th, asked the First Lord of the Admiralty who are the persons composing the Board for considering inventions; whether any recent additions have been made to its membership; and whether the Admiralty is in communication with the Board of Inventions in the United States of America in regard to providing an antidote to submarine warfare?

The Parliamentary Secretary to the Board of Admiralty (Dr. Macnamara) : The Board of Invention and Research comprises—

(1) A Central Committee, consisting of : Admiral of the Fleet Lord Fisher (President); Sir Joseph Thomson, President of the Royal Society; The Hon. Sir Charles Parsons, F.R.S.; Sir George Beilby, F.R.S.; and Vice-Admiral Sir Richard Peirse; with the heads of the Technical Departments of the Admiralty as *ex-officio* associated members.

(2) A Consulting Panel of 14 members, namely : Professor H. B. Baker, F.R.S.; Professor Bragg, F.R.S.; Professor H. C. H. Carpenter; Dr. Dugald Clerk, F.R.S.; Sir William Crookes, F.R.S.; Mr. W. Duddell, F.R.S.; Professor Frankland, F.R.S.; Professor Bertram Hopkinson, F.R.S.; Sir Oliver Lodge, F.R.S.; Sir Ernest Rutherford, F.R.S.; Mr. Gerald Stoney, F.R.S.; Professor the Hon. R. J. Strutt, F.R.S.; and Mr. Richard Threlfall, F.R.S.

There are 12 Sub-Committees working under the Board, and entrusted with different branches of research, each of which comprises one or more of the eminent scientists named above, together with other experts.

Mr. Threlfall and Dr. Dugald Clerk are the most recent additions to the Consulting Panel, and the constitution of the Sub-Committees is altered from time to time as found desirable. Steps have already been taken in regard to the matter referred to in the last part of the question, but it is not advisable to state them in detail.

Mr. Butcher : Do the Board of Inventions meet regularly?

Dr. Macnamara : I imagine so.

ANSWERS TO CORRESPONDENTS

Notice to Correspondents in General.

Applications for commissions in the Royal Naval Air Service should be addressed to the Director of Air Services, Admiralty, S.W. The necessary form and conditions of entry can be obtained from the Secretary of the Admiralty.

Applications for commissions in the Royal Flying Corps should be sent to the Director-General of Military Aeronautics, Hotel Cecil, Strand, W.C.

Those who wish to enlist in the R.N.A.S. should apply to the nearest naval recruiting station or to the R.N.A.S. Drafting Office, Crystal Palace, S.E. Skilled mechanics are taken whatever their army classification, but unskilled men are only taken if they are classified B1, B2, or C1.

Recruiting for the R.F.C. is closed for the time being, and any enquiries should be made to the Officer Commanding, Royal Flying Corps Depôt, Farnborough.

Enquiries with regard to appointments in the A.I.D. should be addressed to the Chief Inspector, Aeronautical Inspection Department, Hotel Cecil, W.C. 2.

With regard to our answer to C. A. H. (Barnet) in last week's Answers to Correspondents column, we have received the following interesting explanations:—

H. S. (R.N.V.R.) writes:—"With regard to your reply to C. A. H. (Barnet), may I suggest the following:—Sound consists of wave motion, and the number of waves reaching the ear per second fixes the pitch of the note heard. As a machine is rapidly approaching it is obvious that more waves will reach the observer per second, and in consequence a higher note will be heard, than when the machine is at rest. When immediately above the observer the machine is neither moving away from nor towards him, and the original correct note is heard, while when receding a lower note should be heard. The nearer the moving object passes to the observer the more sudden the change, e.g. a train whistle when passing through a station. If the machine passes 1,000 ft. or more overhead the change in sound is gradual and spread over some time, as the velocity component of the machine towards the observer is continually varying."

H. W. W. (Hunts) sends the following:—"I note with interest the reply in your issue of 10th to C. A. H. (Barnet) regarding the change in the pitch of the sound of an aeroplane as it comes towards, or recedes from, the listener. The scientific explanation is, I believe, as follows—The pitch of a musical sound depends upon the rate at which a series of aerial vibrations falls upon the ear. Now a 110 h.p. Clerget (let us say) produces a note whose pitch approximates to middle C—(i.e., vibrations are set up, the rate of whose execution is 256 per second.). When at a moderate distance from the machine—100 yards or so—the ear will record the 256 vibrations in practically one second. At 1,000 yards, however, the ear will record the 256 vibrations in a considerably longer period, owing to the fact that (the velocity of sound being only 1,120 ft. per second) a certain amount of time will be absorbed by the travel of sound across the intervening space.

A Zeppelin Over Holland.

ANOTHER outrage was perpetrated against Holland last night, reports the *Daily Telegraph* correspondent on May 8th. For over an hour a Zeppelin flew over parts of the eastern provinces. Coming from the direction of Hanover the airship manœuvred over railways and other points of importance on the Dutch frontier district, flying very low, and using searchlights and fireballs in order the better to carry out its inspection. The Zeppelin was repeatedly fired upon by Dutch frontier guards, also at one place by military cyclists.

Captured French Pilot Escapes.

THE Paris *Excelsior* reports the escape from Germany of a French pilot who was taken prisoner at Verdun during a fight with four enemy aeroplanes, in the course of which he brought down one of the enemy machines. He succeeded in reaching France after covering 218 miles in ten nights, remaining concealed during the day.

"Bravo, Australia!"

In a despatch dated May 6th, Mr. C. E. W. Bean, the official Press Correspondent with the Australian Imperial Forces, tells the following incident:—

A British aviator, after a glorious flight of nearly half an hour about 200 ft. above the German trenches, during the

This lowering of number of vibrations per unit of time, means, of course, a lowering of pitch—as the machine recedes, the tone falls. This phenomenon is, I believe, referred to in most text books on acoustics—the example given being often the whistle of an express train passing through a station. I hope this may prove of interest to you. Your correspondence column is, as a rule, most interesting to me."

Both these correspondents, we notice, are of the opinion that the note rises as the machine approaches and drops as the machine recedes. C. A. H. (Barnet) held the opposite view, i.e., that as an aeroplane approaches the note becomes deeper and deeper, gradually rising again as the aeroplane travels away from the observer. Personally we are inclined to agree with C. A. H. (Barnet), as our own impression is that of a sound gradually deepening as the machine draws near and rising as the machine passes into the distance. The explanations offered by the above correspondents would appear to be diametrically opposite to this impression, and we should like the opinion of other readers on the nature of the change in note, quite apart from any consideration of what causes it.

C. J. B. (Christ's Hospital).

Judging from your rough sketches we should say that machine No. 1 is a Sopwith one-and-a-half strutter, No. 3 a de Havilland 4, while No. 2 cannot be identified.

G. M. (2nd Lieut. R.F.C.).

If the firms you mention cannot supply a compressed air engine for a model aeroplane, we are afraid we cannot give you the address of any firm that would be likely to be able to do so. Perhaps some of our readers may be able to supply the desired information.

H. P. W. (Sheffield).

The weight of a Palmer aeroplane wheel No. 16, measuring 300 x 60 is about 3 lbs. 14 ozs. complete with tube, tyre, and shields.

H. S. (Kensington).

There is a long waiting list, and the chances are against you getting in. The eagle with outspread wings is the badge of the R.N.A.S., and is worn by all officers attached to that service.

L. H. (Tewkesbury).

A fair education is required. It is impossible to absolutely specify to what extent a public school education is not essential.

S. B. (Wolverhampton).

You should apply for admission to the R.F.C. Cadets Corps. Apply to the Director-General of Military Aeronautics, Hotel Cecil, Strand, W.C.2.

X. Y. Z. (Lancaster).

The two papers by Mr. F. W. Lanchester on "The Aerofoil" and the "Screw Propeller" have been reprinted, and can be had in one volume from "FLIGHT" office for 4s., post free.



great attack of the Australians on May 3rd, dropped over the Australian lines the generous message, "Bravo, Australia!" About five minutes later his plane was brought down behind our lines. The work of British aircraft in conjunction with Australian troops has been beyond all praise.

Allied Machines in Holland.

MESSAGES from Amsterdam state that a French aeroplane containing two officers descended on May 12th near Groede, in Dutch Flanders. Both officers have been interned. A British monoplane, marked Firchly (?) 5,154, also landed the same morning near Cadzand, in Dutch Flanders. The two occupants have been interned.

Flying Officers Acquitted.

AFTER a trial lasting six days, a general court-martial at Peterborough on May 12th returned a verdict of "Not Guilty" in the case of five flying officers charged with conduct prejudicial to good behaviour and military discipline, at the Grand Theatre, Peterborough. The officers were immediately released.

Evidence was given by a civilian, who admitted going into the officers' box uninvited and making all the disturbance. Evidence was also given to disprove the suggestion that the officers were under the influence of drink.



FLYING is, without much doubt, largely a young man's job. The age business, judging by the following report, looks like permeating the entire organisation :—

Robert Askew, 16, described as a buyer to an aircraft company, was charged at Feltham on Monday with stealing an electric motor, value £10, belonging to the company.

A Magistrate : Isn't 16 very young for a buyer of munitions ?—Yes, but we cannot get older men.

Askew : A lot of people think me too young and try to throw me out of my job. This charge is only a trick.

Mr. Firth (prosecuting) : Would you pit your experience against an older man ?—Yes, I can prove it.

He said he started at the Royal Aircraft Factory in 1915, i.e., when 14.

The chairman said there would be a conviction, but remanded Askew for inquiries.

IT was an appropriately striking performance of a pilot the other day, at a place where the engineers have come out. The strikers had started an open-air meeting, so the story goes, as the pilot was circling overhead, and he promptly nose-dived straight at the crowd, skimming over them at a height of only a few feet. As he descended, the meeting broke up in ignominious flight, and each time the meeting resumed the airman repeated his performance, until the strikers abandoned the meeting in disgust.

Sounds ingenious, but—

CARRYING mails by aeroplane is about the best method of bringing home to the general public quickly and directly the commercial and every-day possibilities of air-navigation. Already in America, France and Italy, official schemes in this direction are in hand, and in the latter country private enterprise is also to take a hand in exploiting what should prove a very popular and profitable undertaking. Under arrangement, an experiment as a start is to be made by a private company in Italy in conveying the mail between Turin and Rome by aeroplane. The postal fee for letters is to be 2½d.

IT must be a shock to the German people to have the testimony of the Royal airman, Prince Friedrich Karl of Prussia to the humane methods of the much abused and hated Briton. In addition to the evidence in this direction of the Rev. M. Caldwell, of Streatham, who as official Chaplain

to the German prisoners of war in the general hospital in France, was in touch with Prince Karl until the day of his death, the Prince, in a letter to his parents, pays a special tribute to his Australian captors. After describing how he was wounded while endeavouring to escape, he remarked that the Australians treated him in a very friendly and careful manner. He went on : "I had, as you may imagine, lost very much blood, and I was frozen like a tailor. Two soldiers, however, gave me their cloaks and covered me with them. I was carried an endless stretch to the doctor, but always very carefully."

WE may not hanker for the German as a resident in England after the war, but we shall be glad to make one in giving Clara Dubiel an after-war welcome to these shores, and see that she is not out of pocket over the £5 fine with which she has been saddled at Potsdam recently for being kind to English prisoners of war in whose train she was travelling. This sympathetic little book-keeper, who is only 20 years of age, was convicted of "deliberately trying to occupy a place in compartments in which English prisoners were seated," and also, in several cases, of "smuggling parcels into their possession." The court stated that only her age saved her from much severer punishment. How they must love the English, to be sure !

MANY sad memories are touched from time to time by a perusal of the "In Memoriam" column of the *Times*. The following life's story, in a nutshell, has, with all its sadness, a strain of contented resignation which falls now, unfortunately, to the lot of so many left behind to mourn :—

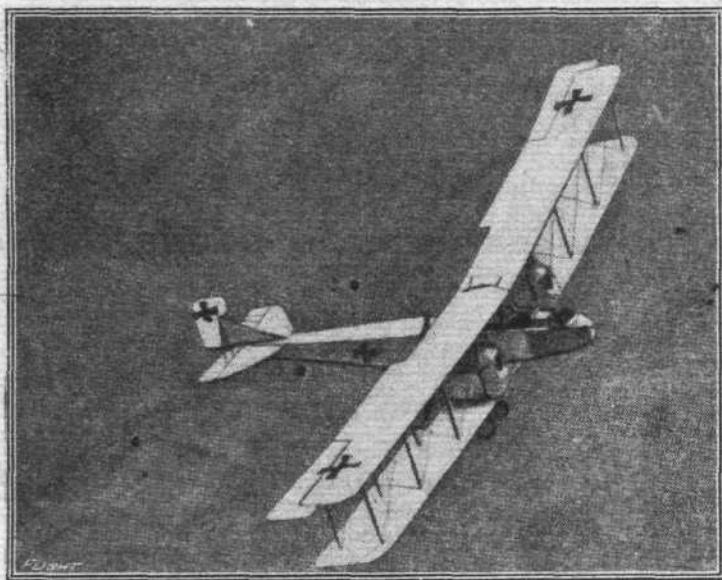
"TERRANÉAU.—In ever-loving memory of 'Our boy,' dear Jack, Flight Sub-Lieutenant Cecil Roy Terraneau, R.N., killed in action while on reconnaissance in East Africa, April 29th, 1916, aged 21 years.

What will it matter, when the war is o'er,
What sea shall contain him or on what shore
He shall be sleeping—far away from his home ?
Not there will we look, but to God's great Dome,
Where the quiet moon, and each shining star,
Will tell us that he is not very far.
And so are we comforted : We know—we know !
That youth has come to claim his own again ;
That nothing beautiful that God has given
Dies utterly, or gives his life in vain."



From "Het Vliegveld."

A Rumpler Biplane.—The annexed illustration, appears to indicate an attempt by the Rumpler firm at better stream-lining, as a hemispherical nose-piece is fitted over the boss of the airscrew, and the sides of the front part of the body are rounded off to gradually carry the curve of the nose-piece into the flat sides of the rear portion of the fuselage. Also, judging by the illustration, it appears that the span is somewhat smaller than in the older type Rumpler biplanes.



A GERMAN GOTHA TWIN-ENGINED BIPLANE.—The span of this big German fighter is 78 ft. 6 ins., length 41 ft. The wings are of about the same span, with balanced ailerons on the upper plane. Three pairs of struts, in addition to the engine struts, are fitted on each side of the body. The latter is of rectangular section covered with three-ply wood in front. Two machine gunners are carried, one in front and one behind, a gangway connecting them. In the floor there is a trap door for firing downwards, the armament consisting, in addition to the machine guns, of three bomb tubes holding 144 bombs. The engines are 6-cyl. Mercedes, each of 260 h.p., driving airscrews placed to the rear of the wings. One of these machines, it is stated by *L'Aerophile*, was brought down by Captain George Guynemer, the famous French "Ace."

"TORPEDOPLANES" is apt and euphonious. Mr. Richard Thirkell is to be congratulated upon the coining of the expressive word.

PROMINENCE is once more being given by the German military authorities to the doings of their more noted air pilots. In the latest summary in this respect it is claimed that, up to May 1st, there were 14 airmen who had accounted for more than 7 enemy machines apiece. The roll is headed by Major Baron von Richthofen, with 52 machines. The next best is Lieut. Wolff with 27 to his credit, while Lieuts. Schäfer, Voss and Bernert have brought down respectively 25, 24 and 22 machines. Capt. Bölkow had shot down 40 machines before he himself came to grief, and Lieut. Immelmann 15.

THE VOSSISCHE ZEITUNG recently announced an extraordinary increase in the supply of "margarine," in terms which are hardly calculated to increase the attractiveness of the products now supplied to the German public as edible fats. It says:

"The provident economic policy of the War Committee for Oils and Fats makes it possible to increase considerably the quantities of raw materials allotted to the margarine factories. The increase in the allotments to the margarine factories will amount to about 33½ per cent. Consequently it will be possible to increase the fat rations by about 1½ oz., and it is a particularly welcome fact that this raising of the rations has been secured for the next six months."

"The War Committee has achieved in the various fat-yielding spheres very favourable successes which have to do with the winning of oil from refuse (*Abfälle*) and the removal of oil from corn and maize. The application of the new refining processes for the purification of oils and fats which are otherwise not fit for food has also helped to make it now possible to increase the fat ration."

UGH! but it makes one shudder with the odour of the "Kadaver" factory revelations still in one's nostrils.

The *Evening News*, for one, evidently made the enquiries in the right quarter suggested in "FLIGHT" as to Wing-Commander Briggs, D.S.O., being in this country in the flesh. But our contemporary claims a point too much in saying it was the first newspaper to announce the escape of this intrepid officer, as witness the following brace of "Airisms" in "FLIGHT":—

April 19th, page 374.

What an interesting story "How Squadron Commander Briggs, D.S.O., R.N., reached London" would make to be sure. Since he did his Friedrichshafen strafing he has been through quite a lot of experiences. His being able to personally congratulate S. V. Sippe, D.S.O., R.N., who was also in the same strafe upon his latest promotion to Squadron Commander, should be an agreeable surprise for both sides.

May 3rd, page 420.

Among the Admiralty announcements of April 30th is the promotion of Squadron Commander Edward Featherstone Briggs, D.S.O., to be Wing Commander, to date December 31st. Quite a fitting compliment to commemorate his safe return to "Blighty."

THE American National Advisory Committee on Aeronautics has drawn up a plan for the training of 2,400 aviators by the end of next March. The U.S. Army is arranging for 3,700 machines in the first year, 6,070 during the second and 9,300 during the third. Looks as if our new allies are taking no chances on a speedy ending to the war.

TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT'S" precursor and sister Journal), of May, 1907. "FLIGHT" was founded in 1908.

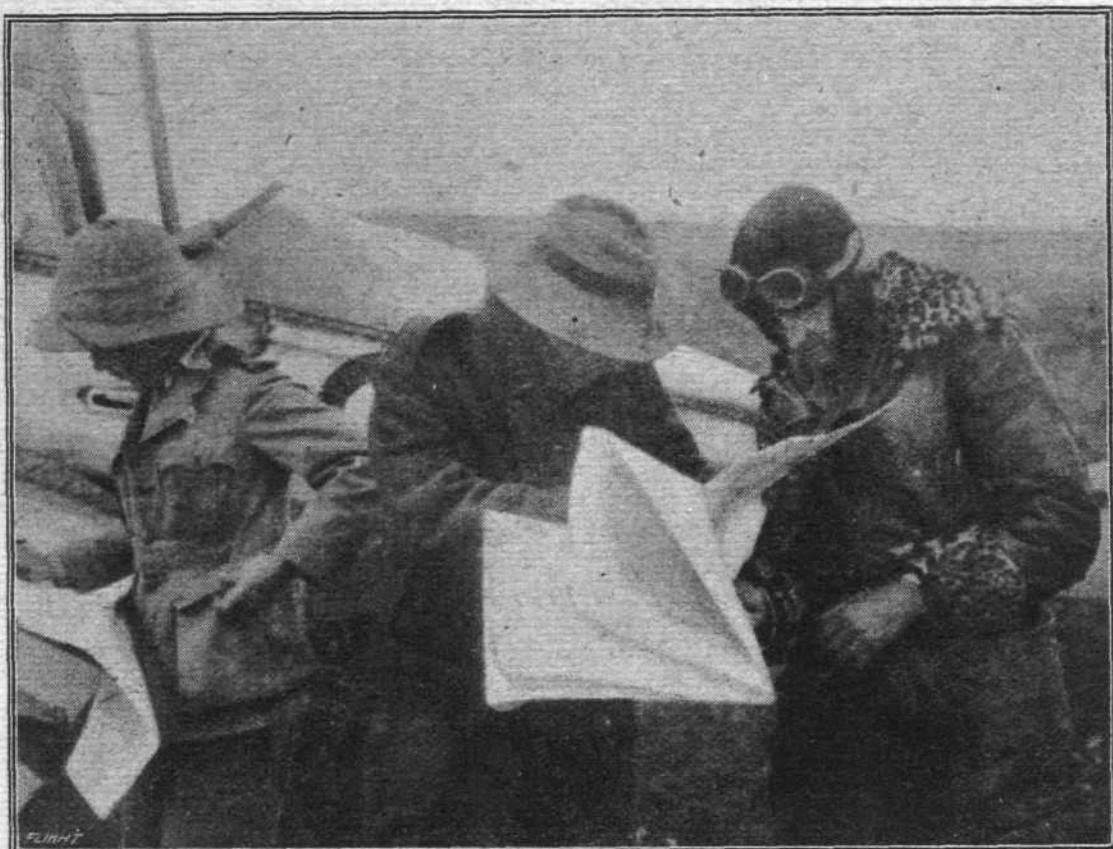
THE FARMAN AEROPLANE.

Henry Farman, whose name is familiar to all the motoring world as one of the most experienced drivers of motor cars, has been attracted by the possibilities of the "open road" surrounding our rotating sphere, and is having a flying machine constructed similar to that used by M. Delagrange. The general characteristics of this type of aeroplane are already familiar to our readers through the photographs which we have published of that particular model. Mr. Farman's aeroplane is to be fitted with a 20 h.p. engine driving a propeller situated in front, and the total weight of the apparatus will be 250 kilogs. At 36 kiloms. an hour it is expected that the aeroplane, which has 30 square metres of surface, will rise in the air. If there are no delays, Mr. Farman hopes to have his machine ready in from six weeks to two months' time.

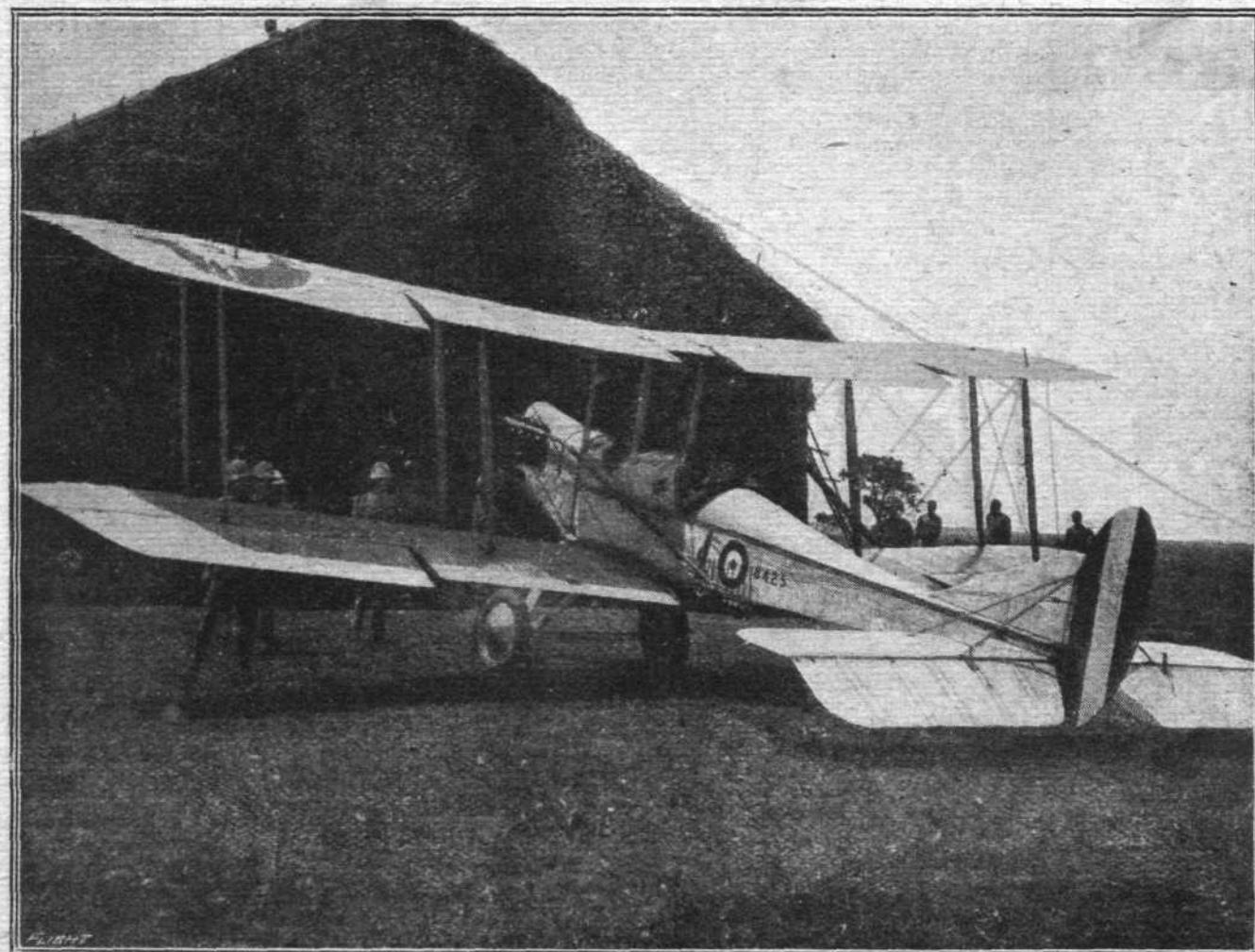


IN AN ENGLISHMAN'S HOME.

MRS. STONE-DEFF (surveying the result of the Zeppelin frightfulness): "Well, Lizzie, and what have you been up to now?"—"Sydney Bulletin."



Captain Moore, the pilot (on the right), studying the route map before his start on the 300 miles flight in the German East African Campaign.



THE GREAT FLIGHT ACROSS SOUTH AFRICA.—General Smuts recently, when accepting the aeroplane subscribed for by the London Chamber of Commerce, had reason to refer to the retaining of the supremacy of the air as being the forerunner of victory. He has intimate knowledge of the activities at the front, and has also in mind the 300 miles South African flight carried out by Captain Moore in the German East African Campaign. In our photograph above, Captain Moore has arrived safely back, the aeroplane being taken into the hangar.

AN HOUR'S BATTLE.

THE Special Correspondent of the *Times*, writing from the War Correspondents' Headquarters, on May 8th, said :—

" This is the story of how five British aeroplanes fought 27 Germans and beat them, sending eight to earth crashing, crippled or in flames. The official *communiqué* has said that we had six aeroplanes engaged. As a matter of fact, six started on the trip from their home aerodrome, but one had engine trouble on the way and was forced to come back. Five only were there when the enemy hove in sight. I speak with authority, because I have spent the day at that same aerodrome, talking to the men who did it and other officers of the squadron, and handling the battle-scars which the machines received in the fight.

" It was on Saturday, May 5th, a day of great heat, when there was a haze so thick that you could hardly see the ground from a height of 2,000 ft. Our men had started fairly late in the afternoon, and at 5 o'clock were well over in enemy country, when, with the sun at their backs, they saw two enemy machines ahead. They tried to close with the enemy, who made some show of giving fight. It was only a show, however, for as our leading machine drew near the Germans turned and made with all speed for home.

" The tactics suggested that the two enemy machines were only a decoy, intended to lure our little flotilla as far as possible from its base—and the suspicion was soon confirmed. Even as we started to chase the two flying enemies out of the haze and void on all sides new fleets came closing in.

" The new arrivals flew in three formations, two of which contained eight machines, and the third contained nine—it is uncertain whether two did not contain nine, but it is better to be on the safe side—making 25 German aeroplanes, all of a uniform fighting type, to whom the other two, which now ceased to run away, joined themselves, making a minimum of 27 enemy machines in all.

" One of the enemy fleets, taking advantage of the thick air, had passed behind our little squadron and came at it, as from the direction of our own lines, straight between it and the sun—an awkward direction from which to have an enemy flying at you in the late afternoon, when the sun is getting fairly low. The other two fleets came from the south-east and north-east. As they approached they spread out so that our men were ringed round with enemies on every side.

" The general order to attack, though given, was hardly needed. Each one of our five, keen as mustard, turned at once for the enemy who was nearest.

" The fight began at about 11,000 ft.; but in the course of the things that followed it ranged anywhere from 3,000 to 12,000, up and down the ladders of heaven. And an extraordinary fact is that, all the while that it went on, the German anti-aircraft guns below kept at work. Usually, as soon as aeroplanes engage overhead, the 'Archies' are silent for fear of hitting the wrong man; and whether the German gunners were drunk with excitement at what was going on above them, or whether it was that our machines formed so isolated and compact a mass in the heart of the great maelstrom that it seemed still possible to shoot at them in safety, is not known. At all events, the tumult in the skies was increased by the constant pumping into the tangled mass of shells from the ground.

" Primarily, any such general *mélée* inevitably breaks up into a series of individual fights. 'Formation,' as it is technically known, breaks up, but nothing could have surpassed the way in which our men fought. Not one of them allowed himself ever to be cut off and isolated from the rest. Not one failed to be ready when a friend was in imminent danger to turn to his assistance. This is the more remarkable as, with the exception of the Flight Leader, all the pilots were practically new men, with little experience of fighting. Some had only been in France a fortnight. Yet no veterans could have exceeded these youngsters in coolness and fighting judgment. As for the Flight Commander himself, he, still a youth, may fairly be called a veteran, for in that battle he reached his 17th German victim.

" The actual fighting lasted for a full hour, from 5 to 6 o'clock, an extraordinary time for such a thing, and during all that hour our men fought tooth and nail. And the fight had lasted but a few minutes when we drew first blood, and an enemy machine which Captain A. had attacked went down in flames, with the wings of one side shot away. Then it was Lieut. B.'s turn. He caught his adversary at close range fairly, and the German aeroplane went down turning over and over as it fell straight down 11,000 ft., leaving a trail of smoke behind. Lieut. C. scored next, his enemy's machine spinning plump down to where, somewhere below the haze, it must have crashed.

" Then, for a moment, it seemed that our luck was turning. Lieutenant B.'s engine gave out and he was compelled to leave the formation. It is a simple phrase, but what it means is that, helpless, and with engine still, the aeroplane dropped out of the fight from 11,000 ft. down to 3,000 ft. It was a dizzying drop, and as he fell an enemy, seeing him defenceless and scenting easy prey, went after him.

" But other eyes were watching. Lieut. C. saw his crippled comrade slipping downward and saw the German diving after. Quick as a flash he followed, and before the German could do his work the British aeroplane was almost touching the tail of his machine, and in another second the German turned clean over in the air and then crashed nose foremost down into the abyss.

" Then, almost by a miracle, B.'s engine caught its breath again. Once more the machine was under control, and B., who was one of those who were new to the game, climbed and rejoined formation. Some 8,000 ft. he had to climb, with the baffled 'Archies' blazing at him from below, up into the inverted hell above, where his four comrades were fighting enemies who outnumbered them six to one. Just as he 'rejoined' another German fell. It was A.'s second victim of the day, and friend and foe alike saw the machine go, sheeted in flames, down into the gulf.

" Then once again it seemed that a throw had gone against us, for, still under control but with flames bursting from its reserve petrol tank, one of our machines began to drop. Again an enemy, glimpsing an easy quarry, dived for the flaming ruin as it fell, but, quicker than he, A. also dived, and while our crippled machine, still belching flames, slid off, with its nose set for home, the German, mortally hit, dropped like a stone.

" It was just retribution. The unwritten laws of this marvellous game prescribe that no honourable fighter attacks an enemy in flames. Such an enemy is out of the fight, and has trouble enough for a brave man. The German who dived for our burning machine knew that he was doing an unchivalrous thing, and it may be that that knowledge unnerved him so that he paid the penalty.

" Strangely enough, our burning aeroplane got home. I have seen the wreckage, with the reserve petrol tank on the roof bearing two bullet holes on one side and great ragged tears on the other where the bullets passed out. The whole tank is scorched and crumpled. The flames had burned away the whole central span of the upper plane. The thick rear main spar was charred and burned through, and two ribs were completely severed and hung with loose blackened ends. Yet, like a great blazing meteor, it crossed our lines and came to earth, not indeed at its own home, but on safe and friendly ground; and as another airman said to me in admiration, 'He made a perfectly topping landing.'

" Meanwhile, the wonderful fight was drawing to a close. The British pilot, Lieutenant D., emptied a belt from his machine-gun into an enemy when so close that his wings almost brushed the other's rudder; and the enemy turned turtle, clear over on his back, and, spurting out a thick column of black smoke, went down.

" Some of the enemy were already drawing off, but our men were in no mood to let them go. It is harder to get out of a losing fighting than it is to begin it, and before the enemy mob could disentangle itself from the battle two more of their machines had gone to earth—one, his third in the fight, falling to Lieutenant C., and one to Lieutenant E.

" Then the last four of our machines, still lords of the air, came home.

" I have seen three of the machines, counted their bullets, fingered the cut wires, and seen the dents on spar and propeller blade; but what, I think, has amazed me most was the fact that yesterday morning four of the aeroplanes, with the same pilots and observers, had been out again. One had brought home with him some brand new scars from an anti-aircraft gun.

" The fame of the battle, of course, has spread, and the heroes have been flooded with congratulations. But for their own part they take it all as a bit of their day's work, and it has not interrupted the rhythmical routine and discipline of the aerodrome.

" There is good ground for believing that the enemy fleet which was smashed up was what is known as 'von Bülow's circus.' There are two of these 'circuses' in the German Army, one commanded by Captain Baron von Richthofen and the other by von Bülow, each comprising from 24 to 30 machines (or that number take the air together), which travel from German aerodrome to aerodrome, staying, perhaps, a week at each, for the purpose of making spectacular flights

and instilling courage into the local flying men and impressing the infantry on the spot. One doubts if Saturday's performance can have done much to brace up German courage, and what one would like to know is what the Germans say when they get home from such a battlefield.

"The German airman nowadays in these parts rarely tries to fight unless he has odds of four to one or so in his favour. The other day he sent up 12 machines to attack one of ours

◆ ◆ ◆ MENTIONED IN DESPATCHES.◆ ◆ ◆

In the long list of names of officers and men who are serving, or who have served, under his command, whose distinguished and gallant services and devotion to duty he considers deserving of special mention, has been brought by Field-Marshal Sir Douglas Haig to the notice of the Secretary of War, among them the following appear:—

Royal Naval Air Service.

Temp. Flight Lieut. B. C. BELL; Lieut. (actg. Sqdn. Comdr.) G. R. BROMET; Temp. Flight Lieut. S. J. GOBLE, D.S.C.; Flight Comdr. B. L. HUSKISSON; Temp. Flight Lieut. (temp. Flight Comdr.) C. R. MACKENZIE, D.S.O.

Staff.

Bt.-Col. (temp. Brig.-Gen.) E. B. ASHMORE, C.M.G., M.V.O., R.A.; Major (temp. Brig.-Gen.) J. H. W. BECKE, D.S.O., Notts and Derby R.

Royal Flying Corps.

Temp.-Capt. E. M. L. AINSLIE, Middx. R.; Temp. Capt. G. C. BAILEY, D.S.O., Spec. Res.; Capt. F. C. BAKER, D. of Corn. L.I.; Temp. Major A. S. BARRATT, M.C., R.F.A.; Capt. R. J. F. BARTON, R. Sco. Fus.; Temp. 2nd Lt. L. W. BEAL; Temp. Capt. A. W. BIRD, Gen. List; Temp. Lt. C. B. BIRD, M.C., R.F.A.; Temp. Capt. B. St. J. BOULTBEE, Gen. List; 2nd Lt. F. BOWER, Northd. Fus.; Temp. Lt.-Col. Hon. J. D. BOYLE, Rif. Brig.; Temp. Capt. N. BREARLEY, D.S.O., M.C., L'pool. R.; Lt. F. E. BROWN, R. Dub. Fus.; Lt. G. S. BUCK, Lond. R.; Temp. Capt. T. F. BULLEN, Som. L.I.; Temp. Capt. K. L. CALDWELL, Spec. Res.; Temp. Capt. A. J. CAPEL, Som. L.I.; Temp. 2nd Lt. R. W. CHAPPELL, Gen. List; Temp. Lt. J. M. CHILD, Gen. List; Temp. Capt. C. M. CLEMENT; Temp. Lt.-Col. F. J. L. COGAN, R.F.A.; Temp. Major R. A. COOPER (Temp. Capt., Yeo.); Capt. E. R. L. CORBALLIS, R. Dub. Fus.; Temp. Capt. J. F. DAVISON, Gen. List; Temp. Lieut. A. G. S. DE ROSS, Gen. List (killed); Temp. Capt. B. L. DOWLING, Gen. List; Temp. Capt. G. F. H. FAITHFULL, Ind. Army; Temp. Major L. F. R. FELL, Spec. Res.; Temp. Lt. O. H. FROST, Middx. R.; Temp. Lt. S. G. FROST, Spec. Res.; Temp. 2nd Lt. E. J. GARLAND, Gen. List; Temp. Lt. J. GILMOUR, Arg. and Suthd. Highrs.; Major A. L. GODMAN, York. R.; Temp. Major N. GOLDSMITH, R.A.; Temp. Capt. J. R. GOULD, King Edward's Horse, Spec. Res.; Temp. Lt. R. W. P. HALL, R.F.A.; Temp. Lt.-Col. J. G. HEARSON, D.S.O., R.E.; Temp. Capt. R. H. JERMAN, R.W. Fus.; Temp. Lt. C. G. JONES, Spec. Res.; Temp. Lt. R. N. K. JONES; Temp. Major J. H. A. LANDON, Essex R.; 2nd Lt. O. LINQUIST, Spec. Res.; Temp. Capt. S. H. LONG, D.S.O., M.C., Durh. L.I.; Temp. Lt.-Col. R. LORAIN, M.C., Spec. Res.; Temp. Capt. J. M. M'ALEERY, Gen. List; Temp. Capt. J. C.



The Raids on Zeebrugge.

THE Admiralty issued the following on May 13th:—

"A very heavy bombardment of an important area at Zeebrugge was successfully carried out on the morning of the 12th inst. by a portion of the forces under the orders of the Vice-Admiral, Dover. The Royal Naval Air Service rendered valuable co-operation, and over fifteen aerial combats took place, in which four enemy machines were destroyed and five others driven down out of control. Two of our machines failed to return, one of which came down in Dutch territory and has been interned."

An official telegram sent out from Berlin on May 11th said:—

"On May 10th several air attacks were made on Zeebrugge and Bruges. In all 60 bombs were counted to have been dropped. No military damage was done anywhere. One enemy aeroplane was shot down by our anti-aircraft guns."

"L. 22" Destroyed in North Sea.

THE Admiralty issued the following announcement on May 14th:—

"Our naval forces destroyed Zeppelin 'L. 22' in the North Sea this morning."

According to a correspondent of the *Star* on the East Coast, news was received early in the morning that Zeppelin "L. 22" was approaching the coast. A squadron of naval aircraft went off in pursuit, and the invader was attacked by a battleplane, by which it was overhauled as it attempted

above one of his aerodromes. Our man got one of the 12, and then came safely home. Again and again, far out over his territory, we fight him with three machines to 10 or a dozen, and hardly ever does he cross our lines, except as a party of three or four, which may slip by our fighting men by hiding behind clouds, and make a sudden raid on one of our observation aeroplanes as it wheels above the battlefield below, or hurriedly dash for one of our kite balloons."

◆ ◆ ◆ DESPATCHES.◆ ◆ ◆

MCMILLAN, R. Sco. Fus. (died of wounds); Temp. Lt. H. C. MULOCK, S. Staff. R.; Temp. Capt. K. D. P. MURRAY, Spec. Res.; Temp. Capt. R. G. H. MURRAY, M.C., Ind. Army; Temp. 2nd Lt. L. A. NORRIS, R.E.; Temp. Lt. J. H. NORTON, Gen. List; Capt. G. A. PARKER, D.S.O., M.C., Northn. R.; Temp. Capt. A. W. C. V. PARR, Rif. Brig.; Temp. Capt. R. K. PILLERS, Northn. R.; Temp. Capt. E. POWELL, Spec. Res.; Temp. Lt. W. E. REED, R.E.; 2nd Lt. P. C. ROUTLEY, Welsh R.; Temp. Major F. M. ROXBURGH, N. Staff. R.; Temp. Brig.-Gen. G. S. SHEPPARD, M.C., R. Fus.; Temp. Capt. F. L. J. SHIRLEY, York. R.; Temp. Lt. R. STEPHENSON, Gen. List; Temp. Capt. J. K. SUMMERS, Gen. List; 2nd Lt. W. T. B. TASKER, Spec. Res.; Temp. 2nd Lt. J. W. R. THOMPSON, Gen. List; Temp. Capt. C. G. TUCKER, Spec. Res.; 2nd Lt. C. T. H. VAISEY, Spec. Res. (died of wounds); Temp. Capt. S. F. VINCENT, Spec. Res.; Temp. Major A. T. WHITELOCK, Spec. Res.; Temp. Lt. E. L. WILLIAMS; Temp. Capt. T. W. WINTER, Spec. Res.; Temp. Lt.-Col. P. K. WISE, R. War. R.; 2nd Lt. F. C. YOUNG, Spec. Res. (killed).

15723 Corp. A. E. ADAMS, 1674 Actg. Sergt.-Major W. J. ALLEN, 14299 Sergt. W. McC. BARNES, 274 Actg. Sergt.-Major G. BATES, 1667 Flight-Sergt. A. E. BEARSELL, 2220 Flight-Sergt. J. BELLAIRS, 1894 Flight-Sergt. D. BLACK, 24107 Flight-Sergt. G. G. L. BLAKE, 7969 Q.-Mr.-Sergt. W. J. BROWN, 91 Actg. Sergt.-Major W. H. BUTT, 3581 Corp. R. BYWATER, 3804 Flight-Sergt. J. F. CAMFIELD, 16320 Corp. T. COLLINS, 3232 Corp. H. E. COTTINGHAM, 3835 Flight-Sergt. S. E. CRYER, 26178 Flight-Sergt. D. DAVIES, 1612 2nd Class Air-Mech. F. G. DAVIN, 15896 Flight-Sergt. J. D. DAWSON, 5403 Flight-Sergt. S. FARROW, 15917 Flight-Sergt. B. W. FELTON, 1705 Actg. Sergt.-Major M. B. FITZGERALD, 4108 Sergt. A. H. FREED, 1187 Flight-Sergt. A. H. GEE, 5998 Flight-Sergt. W. S. GIBSON, 1334 Flight-Sergt. G. B. HARRIES, 15888 Sergt. J. HENDERSON, 20236 Flight-Sergt. C. W. JAMES, 7521 Corp. W. A. JENKINS, 9399 Corp. M. JONES, 3702 Flight-Sergt. J. A. LAWRIE, 32257 1st Class Air-Mech. H. E. LOWE, 104 Actg. Staff-Sergt.-Major A. F. NETHEY, 17062 Actg. Sergt.-Major H. J. PAYNE, 13091 Flight-Sergt. C. H. PERRIN, 11597 Sergt. W. J. PINDER, 18319 Sergt. S. C. ROGERS, 8254 1st Class Air-Mech. J. ROSS, 17122 Sergt. B. P. ROSSI, 6300 Flight-Sergt. E. SANDERS, 5127 Actg. Sergt.-Major W. T. SHARPE, 436 Actg. Sergt.-Major A. H. SIMPSON, 2706 Actg. Sergt.-Major A. W. SKEGGS, 9572 Corp. A. SMALLBONES, 12377 Sergt. H. S. STARLING, 4003 Flight-Sergt. T. STEVENSON, 2048 Flight-Sergt. F. STONE, 12268 Corp. R. TAYLOR, 128 Actg. Sergt.-Major W. G. TURNER, 2359 Flight-Sergt. W. WEBBER.



to escape. "L. 22" was seen to burst into flame. Two of the crew jumped into the sea, but the rest disappeared with the burning mass. The scene of the encounter was 50 miles from the Dutch coast and about 200 miles from the British.

Messages from Amsterdam state that a Zeppelin with three gondolas, which had been cruising over the North Sea, was seen to fall a burning mass into the water.

Aerial Photography in War.

OPENING the exhibition of war photographs at the Victoria and Albert Museum, South Kensington, on May 10th, the Earl of Derby, Secretary of State for War, said this was the first war in which photography had played a large part. There were photographs of what was happening in the theatres of war, but there was one type which was a new type, and to which he asked them to pay great attention—the type taken by our airmen at the risk of their lives, showing the trenches and the positions of enemy guns. That gave him a chance of paying a tribute to the bravest of many brave branches of the Army, who were giving up their lives, not without result, because by giving up their lives in the taking of these photographs they were doing much to save the lives of those who were their comrades in the field.

Uniform Air Service for the Central Empires.

At the invitation of the Austrian Aero Club a conference was held at Vienna on May 9th in connection with the creation of a uniform air service and uniform air traffic law for the Central Powers.

AIRCRAFT AND MOTOR CAR ENGINE DESIGN.*

CONTRASTED FROM THE STANDPOINT OF A DESIGNER AND MANUFACTURER OF BOTH TYPES.

By LOUIS COATALEN.

In addressing myself to the members of the Aeronautical Society of Great Britain, the oldest institution of its kind in the world, I have to bear in mind that a section only of that membership is composed of designers of internal combustion engines. Therefore I have striven to make my remarks this evening as intelligible as possible to those who have not had such training. At the outset, too, I take the opportunity to thank the Admiralty for giving permission for a paper to be read on so instructive a subject with a view to its being discussed within the limits which it is necessary to impose on a topic of this sort in face of our being engaged in the greatest war in history. That belief which appears to obtain in some quarters to the effect that the design and production of an aircraft engine is akin to that of a motor-car one proves, on even casual investigation, to be what the old writers would have styled a vulgar error. By taking a few points which come most obviously to mind, we discover at the very outset that the problems involved by the two propositions are fundamentally different.

Chief Characteristics of a Car Engine.

Consider for a moment the chief characteristics of an internal combustion engine for motor-car service:—(1) Weight is practically no object. (2) Cost is of the utmost importance, therefore there must be the minimum of machining, as instance the fact that the connecting rods of a motor-car engine are not milled, nor are the crankshafts machined all over. (3) It must be capable of production in great quantities at minimum cost; otherwise, with the least amount of labour. (4) It must be silent to the extreme of what is practicable. (5) The maximum effort of which the engine is capable is not needed to be maintained for long at a spell. It seldom works at full power, and the brief duration of such effort explains the extraordinary reliability of even the inferior types of car engines. (6) Flexibility, giving a constant torque at a crank-shaft speed from 300 r.p.m. to 2,000 r.p.m. (7) Of course, this is a torque which corresponds to a very low mean effective pressure, namely, 80 lbs. (8) The compression is relatively low and the valve area small, the cam forms being easy and the valve springs light. (9) The system of lubrication, wherein the oil is carried in the base-chamber of the crank case, suffices. (10) The maximum horse-power required to be developed by any one engine rarely approached 100. In the vast majority of cases it does not exceed 30.

And One for Aircraft Service.

By contrast, the factors governing the design of an aircraft engine may be enumerated thus:—(1) Weight is of prime importance. (2) Cost is not the deciding factor provided the necessary amount of power is obtained for the given overall dimensions of the engine, for its weight both as regards material and fuel, water and lubricant consumption; and that the desired degree of reliability is obtained. (3) The amount of labour necessary to produce a satisfactory aircraft engine of high output is, and will be, always many times what is necessary in the case of a car engine, and is a matter of secondary importance provided the desired results are obtained. No machining is too expensive if it saves weight. (4) Silence is relatively unimportant. (5) The aircraft engine does all its work at practically full power. (6) Flexibility, or evenness of torque, is of very secondary importance, because an aircraft engine is required to develop maximum torque at practically one speed only, or, at most, at an extremely narrow range of speed. (7) But its working range of speeds is such as to call for a very high brake mean effective pressure, say 130 lbs. (8) The compression must be relatively high and the valve area large, while the valve springs must be stronger than for a motor-car, due to the cam form imposed. (9) The high mean effective pressure necessary, coupled with the fact of the engine doing nearly all its work at full power, involves a completely different point of departure in determining details of design and, notably, the exploitation of new methods of achieving lubrication. Experience has demonstrated abundantly that when the base-chamber is used as an oil well, as in motor-car practice, the lubricant soon becomes too hot, therefore too fluid, resulting in reduction of pressure to the main bearings; hence the evolution of the dry sump system for lubricating aircraft engines. Oil viscosity varies greatly with the temperature.

Evolution of the Dry Sump Lubricating System.

I would mention in passing that the history of the engine dry base lubricating system is neither more nor less

* A Paper read before the Aeronautical Society on May 16th, 1917.

than the story of my racing experience on the Brooklands track. In the course of long runs on it years ago it was found that the oil pressure went down more and more the longer each run was continued. Naturally we tried one brand of oil after another with the view to discovering which would retain its viscosity most effectively. Of course, castor oil gave greatly superior results to mineral oils. Even so, however, it soon became plain that the problem was one that could not be solved entirely by the use of a vegetable oil. Indeed, results were quite unsatisfactory, notwithstanding that we greatly increased the effectiveness of the pump employed. Therefore my next step was to use the same pump to force the oil out of the base-chamber through two 1-in. copper pipes arranged round the car. We returned the oil direct from that process of cooling to the service of the bearings under pressure. This proved a great advance as regards maintaining pressure; but the scheme involved all the inconvenience of a long circuit for the oil in connection with which all the cooling was achieved under pressure, because the oil passed quite round the car before being returned to the bearings.

Therefore the next stage was to employ two pumps. One forced the oil out of the base-chamber through a cooler, from which it passed into a tank placed at the back of the car. In this tank the oil was not under pressure of the pump, for the tank itself was merely under atmospheric pressure. In practice it was found that this was really a notable improvement. Thus the bulk of the oil was kept all the time in the tank, which itself was in a draught while the car was travelling, while the base-chamber itself was kept quite empty. From the tank the oil passed to the pump, and was so forced by it into the bearings. Therefore the oil was under pressure only for a short distance, namely, from the pump to the bearings, because, as has been explained already, the tank itself was under atmospheric pressure.

Only when we had arrived at this stage was it found that racing cars with engines of high output could be run for more or less indefinite periods without the temperature of the lubricating oil attaining more than 66° C., at which warmth a very good working viscosity was retained.

(10) Lastly, in contrasting the standard car-engine, the racing-car engine, and the aircraft engine propositions under the headings that have been selected for the sake of illustration it is to note that the total amount of horse power required to be developed by practically all aircraft engines to-day is about 100 minimum, while the maximum totals several hundred horse-power per unit.

Two Distinct Propositions.

It will be seen from those ten points of contrast which, doubtless, might be increased in number, that the aircraft engine of to-day is not akin to the standard motor-car one. Admittedly, the twain are collaterals, both deriving from a common stock, the four-stroke cycle, petrol internal combustion engine. For the rest, the aircraft engine of to-day is, perhaps, as little like the standard motor-car one as that resembles the variety used on a commercial motor vehicle or that installed in a motor boat. In fine, it may be said that, as the stationary gas engine resembles the portable petrol variety to that meagre degree, and scarcely more, does the motor-car engine resemble the aircraft type. It cannot be proved that the aircraft engine has been developed from the touring car variety. On the contrary, it can be demonstrated abundantly that the aircraft engine is quite a distinct branch of the development of the internal combustion engine. Hence many firms that have been strikingly successful in producing car engines for either touring or commercial use have experienced great and, in some cases, unsurmounted difficulty when called upon to change over to the manufacture of power plant for aircraft. The differences apparent in the design become even more pronounced when they are translated into manufacturing problems in the shops.

On the other hand, we may not lose sight of the likelihood that the very rapid evolution of the aircraft engine during this war, and the extraordinary manufacturing experience and developments of which that is the outcome, will at some future time exercise a more or less temporary effect on the design and manufacture of engines for car service.

Be this as may be, in broad terms I am of opinion that the two schools of design, one concerned with each of these problems, will continue to advance for the most part along two distinct lines which will rather become more than less

divergent. Hence on the present occasion little further attention need be devoted to standard engine design for car practice. Suffice it to observe that to date the non-technical opinion of the buying public, which opinion is not to be depreciated altogether, has exercised a not inconsiderable and, on occasion, detrimental influence on the designer and manufacturer. It will be observed, incidentally, that the element affects the proposition of aircraft engine design scarcely at all, especially under the conditions which are beginning to govern the industry towards the conclusion of the third year of war.

The Analogy of the Racing Car Engine.

By contrast, there is another type of engine specially built as distinct from standardised, and which is fitted to a few motor chassis only each year in relation to the total number produced, because it is evolved and employed for racing purposes solely. Admittedly, in the beginnings of the motor industry the racing car of one year became the standard vehicle the succeeding season. With the lapse of time, however, racing became so highly specialised that if the individual competitor was to enjoy any prospect of success during the last four or five years the racing engine had become a proposition utterly distinct from those standardised for service or ordinary civilian motor vehicle uses. This point is proved by a summary of the main characteristics required of a racing car engine, and which we find are to a considerable extent identical with those needed for an aviation engine. Thus :—(1) Weight is of importance. (2) Cost is unimportant. (3) The amount of labour and the time necessary for production are matters of relative indifference provided the maximum output of horse-power is obtained for a given size of engine. That demand has led manufacturers to employ overhead valves, which are also used in aviation service and which so far have been employed comparatively little in standard car practice, partly on account of the principle not being so quiet in operation as the side-valve system. Every part of a racing car engine must be machined. The connecting-rods are milled to the minimum section, and so forth. (4) Silence is of no importance whatever. (5) The racing car engine does all its work at practically full power, but the evenness of its torque has to be extended over very much wider ranges of speed than is needed so far in the case of an aircraft engine. From 1,600 to 3,400 crankshaft r.p.m. is called for in the former case, whereas in the latter the normal speed is 2,100. The last-named figure chances to be no less than 1,300 r.p.m. slower than the capacity of Sunbeam racing car engines. Therefore it will be appreciated that the engine for racing car service is submitted to bigger stresses than the present-day aviation engine; but that this period of high stress in the case of the vehicle variety is much shorter than obtains in that of the aviation type unless, indeed, the car is being run on a track. Even in that event 12 consecutive hours is considered a very long spell, whereas in aircraft service that period of uninterrupted power output is held to be all in the day's work. (6) Under the heading of flexibility the engine for your racing car must be more akin to standard car requirements than to those of aircraft service. This characteristic, therefore, works out as a disadvantage to the racing car engine. When employed on dry roads with efficient gears and so forth the starting torque mounts up to a high figure, whereas in the aircraft engine at starting there is no load on the propeller. It increases, roughly, with the cube of the revolutions. (7) The racing car engine resembles the aviation type in that a very high mean effective pressure has to be obtained with both. In some racing car engines it has amounted to 135 lbs. to the square inch, taken from the brake horse-power developed at the flywheel. (8) As the problem is power for engine weight and volume, and not silence and low cost, great freedom is allowed the racing car engine designer as regards piston clearances, valve timing, compression, largeness of valve area, strength of valve springs, and so forth, the opportunities in this connection approximating much more to aviation than to standard car engine practice. (9) The high mean effective pressure necessary, coupled with the fact of nearly all the work being done at full power, calls for lubrication methods quite distinct from standard car practice, albeit as yet these have rarely approximated to that of aircraft engine practice, though the problems of maintaining pressure in the oil circuit and of keeping the temperature of the lubricant normal are common to racing and aviation engine service. (10) Comparatively large horse-power is needed in the case of all engines for racing cars, the average being anything from 80 to 225 horse-power, therefore much more on a plane with the demands for aircraft service than with those for the touring car, the town carriage, or the utility motor vehicle.

Lastly, outside influence, traceable in the case of designing the private car engine and the commercial motor vehicle one is scarcely, if at all, to be detected in those of the racing car engine and of the aircraft variety. The racing car type has been developed with almost amazing rapidity through various stages along the lines of maximum power combined with low, as distinct from minimum, weight, and with the utmost reliability, notably with a view to enabling the machine to be run for long spells without loss of power.

We might, perhaps, complete our survey of the interrelationship of these three branches of motor engineering enterprise by adding that in the aircraft engine we have to economise weight considerably over the degree that will suffice for racing car practice, while economy of fuel and oil consumption are also more important in the case of the former than the latter. Admittedly, in the racing car engine those two features constitute a special and important factor, but not one that has had to be studied yet on entirely different lines to standard car practice. Accordingly, perhaps we might conclude not unreasonably by stating in general terms that one stage in the development of the aircraft engine is represented by racing car enterprise as well as, perhaps, by certain sporting motor-boat engine work. Endeavours in these directions provided us with the data from which were designed the first engines evolved on lines to be of such efficiency as the present-day aircraft variety.

In face of our being now in the third year of war, and therefore for the most part somewhat out of practice in the matter of racing car engine design, whereas the leading firms in the industry in Europe have by now accumulated much experience of standardising aircraft engines, though of recent years none of them have ever standardised any for racing service, it may be said that the data on which aircraft engines are being designed to-day derives wholly from cumulative experience of aircraft engines, and has ceased to depend in any way on racing car experience. Indeed, on the coming of peace, doubtless it will be found that the position has been wholly reversed from that which obtained before the war. In the future not a little of racing car engine design may derive from aircraft engine practice.

Desiderata in Aircraft Engine Design.

To approach the problem from the correct point of view, we must recognise that the outstanding desiderata in designing aircraft engines to-day may be summarised thus :—(a) Light weight, combined with low fuel and oil consumption, per horse-power. (b) Reliability.

If we can but attain those characteristics with units of not less than, say, 200 horse-power—better still, if we can exploit them in units each up to 600 horse-power—then we can afford more or less to neglect other desiderata as being of minor importance. Nevertheless, happily we can already go a far way towards realising what we might style the minor desiderata, which at this period of the war include :—(a) Simplification to the utmost in face of these engines being placed, for the most part, in the hands of a great number of men semi-skilled in even flying and maintaining them. (b) Fool-proof as much as possible in that some of the most daring Service fliers have not either the temperament or the understanding to spare the engines of which they are put in charge. (c) Accessibility in face of the frequent attention needed by all aircraft engines and of the fortunes of war rendering it necessary on occasion to replace the most vital parts. (d) Standardisation because for the first time in the history of motor engineering we are making engines of high output in series in place of about a half-dozen examples at a time. (e) Suitability of exterior form that the power plant may be accommodated conveniently in the aircraft and occasion the minimum displacement.

Influences on the Aircraft Constructor of the Particular Employment.

Thus there are strict limits to the diametrical size of radial engines, whether of the rotary or of the stationary type, which it is profitable to employ for aircraft work; while in regard to the vertical, or to the V-shaped engines, the nature of the particular service to which each individual engine is to be put likewise imposes certain limits. In certain cases strict limits must be set to overall length of the engine, particularly at a time of war in the air, when, at need, it is essential to lose the minimum time in altering the flight path of the machine from a diving attitude to a very steep climbing one. Again, some sorts of aircraft call for the minimum engine head resistance, but are less imperative as to overall length; hence the six-cylinder type would be suitable for such service, whereas the V-type variety would not be.

In other words, at this period it is impossible to lay down any arbitrary rules as to any one type of aircraft engine being suitable for the needs of all aircraft service. Those needs are

almost as various as are the demands for special varieties of steel and of alloys. Moreover, they are likely to multiply with the lapse of time. Yet between the widest varieties we perceive the essential characteristics of demand to be uniform. This is a great gain alike to the designer and to the manufacturer on the one hand, and to the Services on the other. It means that, when the right scheme of design is evolved, the least possible disturbance is caused in the given factory, though it be concerned with producing power plant of various size, weight, and horse-power output. Therefore the maximum production can be attained, while the problems of management and repair are correspondingly reduced to the minimum. Interchangeability can be exploited to the maximum, and, once the mechanics and pilots have mastered the principles of whatever system of construction is in question, it is found that those principles are applicable to all varieties of the given system of construction.

When we come to systems of construction, again there can be no laying down of hard-and-fast rules, for the sufficient reason that the suitability or otherwise of systems are predetermined by the demands of the aircraft constructor and the aircraft user, which demands are ever varying. Therefore what system may be the most suitable thing possible to attain satisfaction of the demand of to-day is not necessarily the principle on which to work for satisfying the demand of next year, or of five years hence. Thus, while we may make bold to criticise the suitability of this system or that to satisfy the insistent demand of the hour, we must have a care not to be drawn into the making of sweeping assertions about the practicability of any system of construction for the necessarily nebulous needs of the future.

Probably it is little realised that if the aircraft engine designer had not to think of the means at present available to the manufacturer, nor of the time factor, nor of those to whose tender mercies the standardised product will be submitted, he would produce very different designs to fulfil any given purpose from those he evolves to-day. Aircraft engine design resembles motor-car engine production in this particular, that it is all the time a question of compromise. The most successful designer is he who exercises the soundest judgment in weighing a hundred and one factors of the hour and who gives the shrewdest estimate of the relative value of each. Having thus striven to give a notion of what one might style the psychology of aircraft engine designing at this or any period, let us take some of the governing factors of to-day somewhat more in detail. It is not deemed desirable, therefore it is not proposed, to give in a paper of this sort particulars of any engines such as are being or are about to be used by the Services in this war. Instead, it is held to be preferable to review with more or less detail the points that have received most attention in the development of the design of the latter-day aircraft engine.

The Three Main Schemes.

In regard to the general arrangement of aircraft engines, there are several main types, each of which involves advantages as well as disadvantages. The business of the designer is to effect the best compromise possible to fulfil the particular class of service that is had in mind in scheming the individual engine. Of course, multi-cylinders are common to all types of aircraft engines. But the arrangement of the cylinder groupings and settings differs entirely as between one type and another. Doubtless the most generally favoured form is the V type with either 12 or eight cylinders per unit, these being set in two rows on a common crankcase whereby one crank-shaft suffices because one crankpin serves for each pair of opposed cylinders. Undoubtedly next in order of importance is the radial type, in which the cylinders are set in one or more planes with axes radiating from the centre line of the crank-shaft. The two sub-divisions of the radial type of engine are the rotating and the fixed variety. What we may style the straight-line engine constitutes the third main type. In this four, more generally six, and, in a few examples, even eight cylinders, and 12, are placed in a line and are set vertically on a crankcase, the pistons and connecting rods acting on a crankshaft with one crankpin per cylinder in the orthodox fashion of motor-car engine practice.

Inasmuch as each of these three types has advantages peculiar to itself, it follows that each is the most suitable so far available for some particular form of aircraft. For instance, the cross-section or wind resistance area per horse-power is least in the straight-line engine and most in the rotating radial type. This includes the loss of power necessary to rotate the engine. The fore and aft length of the engine, however, which is of great importance in some aircraft, is least per horse-power in the case of the rotating radial type

and greatest per horse-power in the straight-line engine. Moreover, when the straight-line engine is water-cooled, as is generally the case, the rotating radial type gains a further advantage on the score of decreased weight per horse-power. Against this, however, the economy of fuel and oil consumption which can be obtained with the straight-line water-cooled engine is appreciably greater than is possible with the rotating air-cooled type as designed to-day. Somewhere between the two contrasted types of engines as regards the problems of wind resistance and overall length is what is styled the V-type of motor, wherein weight per horse-power is lighter than in the straight-line engine, owing, of course, to the proportionately much smaller crankshaft size in relation to the number of cylinders employed. But if we consider the case of the air-cooled V-type engine, under the score of weight per horse-power, of course, it has to yield place to the rotating radial type.

Unusual Types.

Yet another type which I have produced and standardised during the past year with highly satisfactory results is a development of the V-form of engine in which more than two rows of cylinders are placed on a common crankcase. The particular engine had in mind employs three rows, each of six cylinders, on a common crankcase, each crankpin being connected to three pistons by articulated rods. In this 18-cylinder unit the centre lines of the cylinder make, in relation each to the other, an angle of 40 degrees. This allows of a very good firing diagram. This type of engine is one that is considered very promising for units of very large power. As regards weight per horse-power, it has advantages over both the V and the straight-line types of engines.

A further development of this design, in which the rows of cylinders are increased, brings us to the consideration of the fixed radial engine, which, in my mind, is one that has been sadly neglected. I feel that we shall hear a deal more about it in the near future. Several forms of these engines have been designed and made, but it may be said, in broad terms, that the success of them does not yet appear to be as great as we should be led to anticipate from consideration of the possibilities of this particular form of design.

The question of head resistance might be raised in regard to this engine, in that, when many cylinders are used, the diameter of the projected area of the power plant is increased.

Suitability of Fuselage Section.

In the case of most single-engined aeroplanes or seaplanes a fuselage of circular cross-section is admirable. It can be made large enough to accommodate the fixed radial type engine without increasing unduly the head resistance of the machine. This is not so, however, in the case of multi-engined aircraft, in which the power plant units are placed away from the body of the machine. In these cases increase of head resistance above the minimum necessary for each power unit is the greatest disadvantage; therefore its avoidance is of vital importance. Hence for multi-engined aircraft the straight-line type of engine is the more suitable, particularly as the power per unit at present demanded by the builders of these machines is well within the compass of types that have been produced on the principle wherein the cylinders employed are set in a single row vertically on the crankcase. In the circumstances in which we meet in mid-campaign it is not possible to discuss definitely the size of engine which is most likely to be adopted as standard in the near future.

A particular effect of the war on the evolution of aviation is the rapidity of the advance which has been and which continues to be made in the design and production both of aircraft and of engines for them. Compared with the average of enterprise in normal times, the amount of experiment that has been carried out in these directions during the last year or two is amazing, and the practical results obtained are correspondingly important. In the Sunbeam factory experimental work is held to be of vital importance, in that the discovery of anything that gives advantage over any feature of previous practice is essential for the improvement of the product standardised. Doubtless this accounts for the rapidity with which changes are made in detail of design, also for the fact that the whole question of design is vastly more in a state of flux than the lay mind imagines.

Further, the experience gained by our aviators since the beginning of the war, together with the demand for the engineer to meet their ever-growing needs, have called for continuous evolution in the design of aircraft, all of which has inspired corresponding enterprise in regard to engine construction and production.

(To be concluded.)

UNDER the above heading will be published weekly particulars of a personal character relating to those who have fallen or have been wounded in the country's service, announcements of marriage and other items concerning members of the Flying Services and others well known in the world of aviation. We shall be pleased to receive for publication properly authenticated particulars suitable for this column.

Casualties.

Captain ELDRED WOLFERSTAN BOWYER-BOWER, East Surrey Regiment and R.F.C. (previously reported missing, now reported killed in action on March 19th), was 22 years of age and son of Captain and Mrs. T. Bowyer-Bower, of Bramham Gardens and Ashanti, and grandson of the late Major-General Henry Bower. He had his captaincy in the East Surreys in August, 1916; in the April preceding he had been gazetted flying officer.

Lieutenant R. H. COLES, Yeomanry and R.F.C. (killed on May 9th, whilst carrying out artillery observations), was the youngest son of Coles Pasha, C.M.G., and Mrs. Coles, of Stone House, Bishops Hull, Taunton. He was educated at Cheam, Wellington, and the Agricultural College, Cirencester, where he obtained a diploma. He served with the Yeomanry in Gallipoli and Egypt, and obtained his wings last July. He was Master of the Cirencester Beagles, was a fearless rider across country, and a good athlete, winning many long-distance races whilst at the Cirencester College. His elder brother, 2nd Lieutenant Crewe Coles, East Lancashires, was killed in Gallipoli on June 4th, 1915.

Second Lieutenant GUY EVERINGHAM, R.F.C., the eldest son of Mrs. Everingham-Wormald, late of Vaenor Park, Llanidloes, now of Colwyn Bay, previously reported missing, was killed on April 8th. He enlisted in October, 1914, in the Royal Welsh Fusiliers, obtaining his commission in February, 1915. He served with his battalion as signalling officer, and in France as bombing officer in the trench mortar battery until he entered the R.F.C. last September. He soon obtained his observer's wing on the field. During his leave last February he was married to Gladys, second daughter of Mr. Frank Brown, of Lynwood, Llandudno, returning to the Front two days later. Lieutenant Guy Everingham's only brother, "Robin," was killed in Gallipoli one week before the evacuation.

Second Lieutenant HERBERT MARSHALL HEADLEY, Royal Field Artillery, attached R.F.C. (reported missing on March 11th, now unofficially reported killed on that date), was only son of Mr. and Mrs. E. M. Headley of Uplands, Redhill. He was 19 years of age, and had his commission in the Royal Artillery in May, 1915.

Second Lieutenant DOUGLAS EDWARD HOOD, Bedford Regiment, was the elder son of Mr. and Mrs. Thomas M. Hood, of Rio de Janeiro. Born at Pernambuco in 1896, he was educated at Forest School, Walthamstow, and Felsted School, Essex, and at the outbreak of war was an apprentice at Messrs. Vickers' Works, Erith. He enlisted in the London Scottish, later received his commission in the Bedford Regiment, and shortly after became attached to the R.F.C., quickly gaining his "wings." Last February he returned to the Bedford Regiment, and went to the Front on the 14th of that month. He was killed on April 14th.

Major JOHN BURGH TALBOT LEIGHTON, M.C., Scots Guards and R.F.C., who died of wounds on May 7th, aged 25, was the elder son of Sir Bryan and Lady Leighton, of Soton Park, Shrewsbury, and was educated at Eton and Sandhurst. He was gazetted into the Scots Guards in 1912, and on the outbreak of war was seconded to the R.F.C., having taken his pilot's certificate in the previous summer. In November, 1914, he flew to France, where he remained nine months, and was then sent to Egypt, where he gained the Military Cross. He returned to England to take command of a squadron, and was sent to the Front again last year.

Flight Sub-Lieutenant LOUIS MARCUS BASIL WEIL, R.N.A.S., attached R.F.C., was the eldest son of Mr. and Mrs. B. B. Weil. He was reported missing by the Admiralty on April 7th, and news unofficially received on May 11th states that he died on April 6th, having been shot through the head by enemy fighting machines. He was born in 1899, and was educated at Clifton.

Flight-Lieutenant LEWIS MORGAN, R.N. (accidentally killed on May 11th), was second and only surviving son of Captain and Mrs. L. H. G. Morgan, of Cheddon, Taunton.

Missing and Prisoners of War.

Mr. and Mrs. Percy Adams, of 14, Vernon Road, Edgbaston, have received a telegram from the International Red Cross of Geneva stating that Lieutenant A. T. ADAMS, R.F.C., reported missing since April 5th, is a prisoner of war in Germany.

Second Lieutenant A. CHAYTOR PEPPER, R.F.C., reported missing on April 7th, is his father Mr. Arthur J. Pepper, of the firm of A. J. Pepper and Co., 54, Frederick Street, Birmingham, now officially learns, a prisoner of war in Germany. Second Lieutenant Pepper, who is 21 years of age, was gazetted to the Worcester Regiment, in February, 1915, and served in Egypt. Subsequently he was transferred to the R.F.C.

Captain JAMES STUART, Flight-Commander, Royal Inniskilling Fusiliers, attached R.F.C., reported missing since April 13th, is the son of Mr. James Stuart, of Somerset, Coleraine, Co. Londonderry. Captain Stuart was born in September, 1896, in Queensland, Australia, and was educated at the King's School, Parramatta, N.S.W., and Cheltenham College, England; entered the Royal Military College, Sandhurst, at end of April 1915, passed out in September, and went to train for the R.F.C. at Farnborough. He obtained his pilot's certificate in October and his "wings" in November. He was posted to his squadron, and flew out to France on December 23rd, 1915, and was there on active service until the following September, when he was posted to the Home Establishment until February, 1917, when he went again to France on active service.

Lieutenant ARTHUR DARLEY WHITEHEAD, R.F.C., reported missing on March 11th, son of Mrs. Arthur Whitehead, 12, West Halkin Street, is a prisoner of war in Germany, slightly wounded, and getting better.

Married and to be Married.

The engagement is announced of Captain WYNWARD ANTHONY, late R.F.C., only child of Mr. and Mrs. A. Anthony, of Capel House, Colchester, and ROSAMUND ANGARAD KATHLEEN (KITTY), fourth daughter of Mr. and Mrs. LLEWELYN LLOYD, of The Yew Trees, Kirby-le-Soken, Essex.

The engagement is announced between HUBERT POYNTZ-GAYNOR LEIGH, R.N., R.N.A.S., second son of Mr. and Mrs. E. Leigh, of Cobridge, Staffs., and DOROTHY MARY ISABELLE, only daughter of Mr. and Mrs. S. J. SIMPSON, of Bank House, Burslem, Staffs.

The marriage arranged between CHARLES BRIAN WAINWRIGHT, R.F.A., attached R.F.C., eldest son of Mr. C. H. Wainwright, J.P., and Mrs. Wainwright, of Hill House, Edgware, and VIOLET MYFANWY, elder daughter of Captain W. J. FOSTER, R.A.M.C. (T.), and Mrs. FOSTER, of Downs, Reading, will take place on Saturday, June 2nd, at St. Mary's Church, Reading, at 11.30 o'clock. All friends will be welcome at the church.

Items.

Major-General H. Trenchard, commanding officer of Flight-Commander Capt. ALBERT BALL, D.S.O., M.C., who has now been missing a week or more, pays a fine tribute to the work of Capt. Ball in the following communication received by his father, Alderman A. Ball, of Nottingham: "I very much regret having to tell you that your son, Captain Ball, is missing, but sincerely hope he has landed safely. As you know, he was the most daring, skilful, and successful pilot the R.F.C. has ever had. Everybody in the Flying Corps has looked upon him as their own personal asset, and he was a most popular officer. His good spirit was infectious, as whichever squadron he was with the officers of it tried to work up to his level and reputation. I have never met a man who has been so successful as he was in such a short time, so modest, and so reliable."

Lieutenant PIERS WARBURTON, who was acting as observer for Flight-Commander Leece Robinson is, it is stated on good authority, also well and a prisoner in Germany.

The British Air Services

PER ARDUA AD ASTRA

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, it is not repeated in this column.

Royal Naval Air Service.

Admiralty, May 8th.

The following Flight Sub-Lieuts. promoted to Flight-Lieuts., all with seniority April 1st: C. Perrett, A. F. E. Warner, A. V. Bowater, and A. M. Wastell.

The undermentioned Temp. Flight Sub-Lieuts. promoted to Temp. Flight Lieuts., with seniority as stated: H. S. Kealey, C. F. B. Penley, H. E. C. Plowden, C. R. Carr, E. M. Morgan, C. Laurence, J. S. Browne, M. J. Golding, R. E. Nicholson, R. E. Dean, C. L. E. Geach, C. J. Hallinan, B. C. H. Cross, W. G. Pigott, M. G. Gill, E. B. Thompson, G. G. Simpson, C. W. Scott, R. R. Soar, H. C. Irwin, H. V. Worrall, R. J. Slade, P. S. J. Owen, A. Sparrow, S. E. Taylor, W. H. S. Aplin, S. P. Martin, E. P. Hicks, I. Macdonald, H. V. German, H. A. J. Wilson, T. R. Hackman, J. G. Hudson, R. G. Gardner, J. F. Horsey, B. S. Wemp, T. G. M. Stephens, F. C. Henderson, A. F. Buck, J. F. Jones, J. C. Mitchell, G. D. Smith, G. L. E. Stevens, W. H. Wood, H. P. Watson, C. Murray, L. W. M. Lloyd, R. H. Horniman, H. W. Campion, W. P. Nicholls, E. E. Deans, G. H. Simpson, A. B. Shearer, H. W. Evans, J. C. Ralton, R. Davies, I. G. Kelly, G. C. C. Kilburn, M. Lyon, T. R. Spence, J. W. Walton, C. J. Moir, G. Moore, P. S. Fisher, G. F. Meager, A. E. Popham, S. Edwards, K. G. Macdonald, P. E. Beasley, K. F. Saunders, H. E. P. Wigglesworth, D.S.C., W. Huggan, W. R. M. Hill, H. L. Hitch, H. R. Aird, H. A. Paulthorpe, H. T. Jones, G. S. Abbott, G. G. McHardy, H. Rampling, P. A. F. Belton, C. E. Moore, J. Gorman, C. J. Wyatt, T. H. Newton, J. R. S. Devlin, W. R. Kenny, A. Durstan, R. A. Littell, D.S.C., J. R. Ross, T. G. Culling, J. L. A. Sinclair, S. Nixon, G. M. T. Rowsse, D. R. Baylis, E. G. Hopcraft, F. D. Casey, B. A. Trenchmann, D. A. H. Nelles, April 4th: J. E. D. Boyd, W. A. K. Dalzell, B. A. Millard, S. G. Beare, A. J. Nightingale, C. G. Knight, C. W. Greig, and R. E. Greensmith, Jan. 1st.

Temp. Prob. Flight Officer R. B. R. Ashworth and Ord. Snn., R.N.V.R., H. W. White granted temp. commissions as Sub-Lieuts., R.N.V.R., both with seniority May 7th.

The undermentioned entered as Temp. Prob. Flight Officers, all to date April 29th: M. L. Cooper, C. M. Hyslop, M. N. Barling, R. Bolton, R. G. Bumdey, G. G. Gravels, O. W. Pellatt, J. D. Southerton, E. J. L. Hope, N. E. Williams, W. E. G. Mann, R. A. Fearnley, G. H. Phillips, L. Ashfield, J. T. Cameron, W. J. Attwood, J. Hancock, J. H. Williams, M. D. Carver, M. E. Burnham, J. P. King, J. K. A. Jeakes, W. S. Pattinson, W. J. Langlois, W. E. Gray, C. E. Emerson, T. E. Climates, B. B. Caswell, C. N. H. Bilney, G. F. Hodson, B. G. H. Keymer, W. A. Ashworth, W. S. Ashby, J. L. Mayer, and C. T. Dodd.

Admiralty, May 9th.

The undermentioned Temp. Flight-Lieuts. reappointed as acting Flight-Com., all to date May 7th: H. G. Brackley, T. F. Le Mesurier, I. N. C. Clarke, W. E. Gardner, A. M. Shook, R. J. O. Compston, C. D. Booker, H. G. Holden, H. G. Travers, and L. S. Bredner.

W. C. Broadhead granted temp. commission as Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., date April 29th.

Leading Mech. F. W. C. Hewton promoted to Temp. Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., dated May 8th.

R. G. G. Maund and F. C. Smith granted temp. commissions as Sub-Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., dated May 8th.

W. J. King entered as Temp. Prob. Flight Officer, and appointed to the "President," additional, for R.N.A.S., dated April 29th.

The following promoted to Warrant Officer, 2nd grade, all to date May 7th: Chief Petty Officers, I., J. Roberts, J. C. Scott-Hendry, J. T. Gibson, H. Little, M. S. Keogh, and C. F. Cluney; Chief Petty Officers, III., G. Croft, S. H. Reynolds, and W. R. Casting.

The following have been promoted to Temp. Warrant Officers, 2nd grade: Chief Petty Officers, II., H. J. Phillips, H. H. Kalber, F. S. Chapman, G. G. Mobbs, C. W. Harrison, A. J. Moore, F. C. Matten, T. F. Ems, and C. W. Raymond; Chief Petty Officers, III., H. Chaplin, R. Frater, H. Nicholas, H. G. Webster, A. S. Roberts, F. O'Donnell, E. J. Williams, and G. V. Russell.

The undermentioned promoted to Temp. Warrant Officer, 2nd grade, all to date May 7th: Petty Officers A. Blackmore, J. D. E. Symons, and Leading Mech. R. Dodd.

Admiralty, May 10th.

T. A. Cotton granted a temp. commission as Lieut., R.N.V.R., with seniority May 9th.

S. H. Barber entered as Temp. Lieut., R.N.V.R., to date May 8th.

C.P.O. M., III (E), R.N.A.S., S. M. Rowlands entered as Temp. Sub-Lieut., R.N.V.R., to date May 8th.

Chief Art. Engr. (Warrant Officer, 1st grade) F. W. Scarff promoted to acting Engr. Lieut., to date May 8th.

J. M. Dawson entered as Temp. Prob. Flight Officer, to date May 4th.

Admiralty, May 12th.

A. E. Holder granted a temp. commission as Lieut., R.N.V.R., and appointed to "President," additional for R.N.A.S., to date May 11th.

M. H. Whitelegge and C. Hayward entered as Prob. Flight Officers (temp. service), and appointed to "President," additional for R.N.A.S., to date April 11th.

Royal Flying Corps (Military Wing).

London Gazette, May 8th.

Flight Commander.—2nd Lieut. (Temp. Lieut.) S. E. Pither, K.O. Sco. Bord., from a Flying Officer, and to be Temp. Capt. whilst so employed; April 25th.

Flying Officers (Observers).—Temp. Lieut. (Temp. Capt.) J. B. Solomon, Oxf. and Bucks. L.I. from a Staff Officer, 2nd Cl., and to relinquish the rank of Temp. Capt.; Mar. 26th, seniority May 25th, 1915. Temp. 2nd Lieut. G. Heasman, attd. King Edward's Horse, S.R.; April 20th, seniority Nov. 29th, and to be transfd. to Gen. List. April 19th: Temp. 2nd Lieut. R. G. Torrance, A. Cyclist Corps, seniority Jan. 1st, and to be transfd. to Gen. List; 2nd Lieut. (on prob.) A. M. West, S. Staff. R., S.R., from Linc. R., with seniority from Jan. 25th, and to be sec'd. 2nd Lieut. A. Barr, R. Highrs. (T.F.), and to be sec'd.; April 20th, seniority Feb. 3rd. April 19th: Temp. Lieut. P. La T. Foster, Manch. R., with seniority from Feb. 12th, and to be transfd. to Gen. List. Temp. Lieut. W. Franklin, Dorset R., seniority Feb. 22nd, and to be transfd. to Gen. List.

Equipment Officers, 3rd Class.—Temp. 2nd Lieut. (on prob.) P. G. Pickwell, Gen. List; Mar. 19th. Qmr. and Hon. Lieut. W. F. Kisbey, (T.F. Res.); April 21st.

School of Technical Training (Men).

Commandant (graded as a Depot Commander).—Qmr. and Hon. Lieut. (Temp. Maj.) J. H. Wilford, R.F.C., from a special appt. (graded as a Park Comdr.), and to be Temp. Lieut.-Col. whilst so employed; April 11th.

Chief Instructors (graded as Park Commanders).—April 11th: Lieut. (Temp. Maj.) L. W. F. Turner, S.R., from a Chief Instr., R.F.C. School of Mil. Aeronautics (graded as a Sqdn. Comdr.), and to retain his temp. rank whilst so employed; Temp. Maj. I. U. D. Truman, Gen. List, from Comdt., Scottish School of Fitters (graded as a Park Comdr.); Capt. V. O. Rees, Lond. R. (T.F.), from an Instr., R.F.C., School of Mil. Aeronautics (graded as an Equipment Officer, 1st Cl.), and to be Temp. Maj. whilst so employed.

Instructors (graded as Equipment Officers, 2nd Class).—11th April: Lieut. J. D. Troup, S.R., an Equipment Officer, 2nd Class; 2nd Lieut. (Temp. Lieut.) H. E. Steinberg, S.R., from Chief Instr., Scottish School of Fitters (graded as an Equipment Officer, and Cl.), and to retain his temp. rank whilst so employed; 2nd Lieut. W. Millett, Gen. List from an Equipment Officer, 3rd Cl., and to be Temp. Lieut. whilst so employed.

Adjutant.—2nd Lieut. (Temp. Capt.) F. E. Vaughan, Middx. R. (T.F.), and to be sec'd.; April 11th.

Equipment Officer, 2nd Class.—Temp. 2nd Lieut. A. MacKay, Gen. List, from the 3rd Cl., and to be Temp. Lieut. whilst so employed; April 11th.

Netheravon School of Fitters.

Chief Instructor (graded as an Equipment Officer, 2nd Class).—Temp. 2nd Lieut. (Temp. Lieut.) A. Latimer, Gen. List, an Equipment Officer, 3rd Class, relinquishes his appointment and the rank of Temp. Lieut.; April 11th.

Memoranda.—The undermentioned to be Temp. Lieuts. whilst serving with R.F.C. April 1st: 2nd Lieuts.—A. H. W. Fleming, Norf. R. (T.F.); G. L. Castle, R.H. and R.F.A.; J. B. F. Austin, Hrs.; D. H. S. Davies, R. War. R.; H. G. P. Ovenden, E. Surr. R.; A. G. A. Davis, Devon R.; R. Smith, Yorks. L.I., S.R.; and Lieut. (on prob.) C. W. Hayne, Essex R., S.R. 2nd Lieuts.—E. G. E. Donaldson, R.F.A., S.R.; T. F. Steele, Arg. and Suth. Highrs., S.R.; A. F. T. Ord, W. York. R., S.R. 2nd Lieuts. (on prob.)—C. J. Pike, R.F.A., S.R.; G. J. Scaramanga, N. Staff. R., S.R.; L. J. Riordan, R.F.A., S.R. 2nd Lieut. B. G. L. Ellis, R. Guernsey Art. and Engrs.

Supplementary to Regular Corps.—2nd Lieut. (on prob.) H. D. F. Fraser resigns his commission; May 9th.

London Gazette Supplement, May 9th.

Wing Commander.—Bt.-Maj. (Temp. Maj.) C. E. C. Rabagliati, M.C., Yorks. L.I., from a Sqdn. Comdr., and to be Temp. Lieut.-Col. whilst so employed. April 11th.

Flight Commander.—Temp. 2nd Lieut. H. J. Larkin, Gen. List, from a Flying Officer and to be Temp. Capt. whilst so employed; April 22nd.

Flying Officers.—Temp. 2nd Lieut. (on prob.) H. C. H. Cooper, Gen. List; April 9th. Temp. 2nd Lieut. (on prob.) R. P. Hood, Gen. List; April 13th. Temp. 2nd Lieut. (on prob.) R. W. L. Anderson, Gen. List; April 15th. April 17th: Temp. Lieut. J. C. B. Firth, Shrops. L.I., and to be transfd. to Gen. List; Temp. 2nd Lieut. C. A. Cooper, E. York. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. T. J. West, M.C., Gen. List, from a Flying Officer (Ob.), seniority July 1st; Temp. 2nd Lieut. (on prob.) R. A. Young, attd. R. Fus., and to be transfd. to Gen. List; Temp. 2nd Lieut. (on prob.) C. E. Worthington, Gen. List. April 18th: 2nd Lieut. F. W. Illingworth, Sco. Rif., and to be sec'd.; Temp. 2nd Lieut. B. P. B. Carter, S. Lan. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. W. Gilchrist, Rif. Brig., and to be transfd. to Gen. List; 2nd Lieut. J. A. Hutchison, S.R.; Temp. 2nd Lieut. R. A. W. Powell, attd. Suff. R., and to be transfd. to Gen. List. April 19th: Temp. 2nd Lieut. H. L. M. Dodson, A.S.C., and to be transfd. to Gen. List; Temp. Lieut. L. E. Jenkins, N. Lan. R., and to be transfd. to Gen. List; Lieut. F. Lindsay, Lond. R. (T.F.), and to be sec'd.; 2nd Lieut. W. H. Kelley, S. Lan. R. (T.F.), and to be sec'd. Temp. 2nd Lieut. L. N. Hollinghurst, Middx. R.; 2nd Lieut. (on prob.) R. R. Riggs, S.R. Temp. 2nd Lieut. H. I. Hammer, Gen. List, from a Flying Officer (Ob.); April 20th, seniority from June 4th.

Special Appointments.—Graded as a Park Comdr.—Qmr. and Hon. Lieut. (Temp. Capt.) J. E. Parkin, R.F.C., an Equipment Officer, 1st Cl., and to be Temp. Maj. whilst so employed, vice Qmr. and Hon. Lieut. (Temp. Lieut.-Col.) J. H. Wilford, R.F.C.; April 11th. Graded as an Equipment Officer, 2nd Cl.—Temp. 2nd Lieut. L. Legge, Gen. List, an Equipment Officer, 3rd Cl., and to be Temp. Lieut. whilst so employed, vice 2nd Lieut. (Temp. Lieut.) H. G. Gold, S.R.; Feb. 28th.

Equipment Officers, 1st Class.—From the 2nd Cl., and to be Temp. Capt. whilst so employed. Mar. 1st: 2nd Lieut. (Temp. Lieut.) G. Jacques, S.R.; 2nd Lieut. (Temp. Lieut.) (S. G. Frost, S.R.

2nd Class.—From the 3rd Cl. and to be Temp. Lieuts. whilst so employed. April 11th; 2nd Lieut. E. J. Street, Gen. List; 2nd Lieut. H. Jones, Gen. List; 2nd Lieut. J. H. Winch, Gen. List. Lieut. G. D. Etches, S.R., from the 3rd Cl.; April 23rd.

3rd Class.—Mar. 27th: Lieut. C. F. R. Johnston, R. Sco. Fus. (T.F.), and to be sec'd.; 2nd Lieut. (Temp. Lieut.) R. D. Wills, Som. L.I. (T.F.), and to be sec'd. Qmr. and Hon. Lieut. C. Harvey, Lond. R. (T.F.), to be Temp. Lieuts.

Memoranda.—The undermentioned 2nd Lieuts. (T.F.), to be Temp. Lieuts. whilst serving with R.F.C. April 1st: N. J. Wenger, Yeo.; L. A. T. Strange, E. Kent R.; F. L. Fletcher, Manch. R.; H. A. P. Bale, R.E.; J. Cairns, R.E.; R. Robertson, Hamps. R.; H. L. Devlin, Arg. and Suth. Highrs.; H. I. Forded, Lond. R.; J. F. Lawson, R.G.A.; D. F. Stevenson, Yeo.; J. A. Stedman, R.H. and R.F.A.; V. L. A. Burns, R.H. and R.F.A.; C. L. Veitch, N. Lan. R.; A. Rowbottom, Bord. R.; E. W. Hallam, Yeo.; B. Smith, Essex R.; H. Welch, R.H. and R.F.A.; P. A. Russell, Yeo.; G. W. Gillespie, Middx. R.; G. L. Barratt, Linc. R.; C. T. L. Donaldson, Yeo.; L. E. Allan, Yeo.; G. T. Beer, Devon. R.; L. M. Woodhouse, Yeo.; A. W. Hogg, Yeo.; A. C. Hendry, M.C., Gord. Highrs.; J. H. L. Varcoe, M.C., Middx. R.; W. Moyes, R. Scots; J. Brodie, Cyclist Bu.; K. R. Furniss, Yeo.; L. B. Jones, Welsh R.; G. B. Barker, R. War. R.

The undermentioned to be Temp. 2nd Lieuts. (on prob.) for duty with the R.F.C.: Trygve Gran; Jan. 1st. Sydney Thomas Josken, late Flight Sub-Lieut. R.N.A.S.; April 24th. John Douglas Fairbairn; April 27th. Erroll Suvo Chunder Sen to be Temp. Hon. 2nd Lieut. for duty with R.F.C.; April 24th.

Supplementary to Regular Corps.—2nd Lieut. (on prob.) H. J. Lane relinquishes his commission; May 10th. The Christian names of 2nd Lieut. Francis Chisholm Young (since killed in action) are as now described, and not as in the *Gazettes* of July 11th and 29th, 1916. The undermentioned 2nd Lieuts. (on prob.) are confirmed in their rank: A. H. Barnard, R. S. Phelan, A. P. Sargeant, F. Thomas, G. E. Thomas, A. F. Warner, J. F. MacKinnon, F. H. Baguley, J. A. Hutchison, R. C. Steele, M. J. Morris. The undermentioned to be 2nd Lieuts. (on prob.) April 24th: H. G. Bell, D. McI. Mitchell, J. S. Reid; April 27th. May 4th: P. Avery, C. G. Boot, W. Calvert, A. B. Smith; F. O. Sonderbye, W. S. Smart, E. W. Vine, W. J. Walford.

London Gazette Supplement, May 10th.

Adjutant.—Temp. Lieut. H. H. Walmsley, Border R., and to be transfd. to Gen. List, vice Lieut. G. C. Gold, R.F.C., S.R.; April 1st.

Flight Commander.—2nd Lieut. S. P. Simpson, Bedf. R., from a Flying Officer, and to be Temp. Capt. whilst so employed; April 23rd.

Flying Officers.—Temp. 2nd Lieut. (on prob.) R. E. Money-Kyrle, Gen. List; April 17th. Lieut. C. T. Sanctuary, R.F.A. (T.F.), from a Flying Officer (Ob.) (sen. April 1st, 1916); Temp. Lieut. R. W. Ellis, R.A., and to be transfd. to Gen. List; Temp. 2nd Lieut. (on prob.) F. P. Brown, Gen. List; Temp. 2nd Lieut. (on prob.) D. L. Nutt, Gen. List, 2nd Lieut. A. E. McKeever, S.R., Temp. 2nd Lieut. (on prob.) W. Davidson, attd. Essex R., and to be transfd. to Gen. List; April 19th. Lieut. G. L. Lumden, Canadian Int.; Lieut. H. D. Williams, S.R., from a Flying Officer (Ob.) (sen. July 15th); Temp. 2nd Lieut. K. L. Martinson, R.A., and to be transfd. to Gen. List; Temp. 2nd Lieut. (on prob.) D. McLaurin, attd. E. Surr. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. C. K. Scott Gen. List; 2nd Lieut. J. M. Warnock, S.R.; 2nd Lieut. (Temp. Lieut.) F. N. Chadwick, Manch. R. (T.F.), and to be seed.; Lieut. G. D. Hunter, Can. Inf.; Temp. 2nd Lieut. (on prob.) R. Harrison, attd. Hamps. R., and to be transfd. to Gen. List; 2nd Lieut. D. A. McDougall, S.R.; April 21st. Temp. 2nd Lieut. F. W. Day, Gen. List, from a Flying Officer (Ob.) (sen. from May 27th, 1916); Temp. Lieut. R. H. Spencer, R.A., and to be transfd. to Gen. List; Lieut. L. A. Smith, Can. Gen. List; Temp. 2nd Lieut. (on prob.) R. Dutton, Gen. List; April 22nd. Temp. 2nd Lieut. (on prob.) J. A. Pattern, Gen. List; April 23rd.

Flying Officers (Observers).—2nd Lieut. G. Bryers, North'd. Fus. (T.F.), and to be seed.; Oct. 20th (substituted for notification in *Gazette* of March 9th). 2nd Lieut. W. R. Ashwell, Leic. R. (T.F.), and to remain seed.; April 21st, seniority Jan. 29th. Temp. 2nd Lieut. G. R. O'Sullivan, R. Ir. Rif., and to be transfd. to Gen. List. 2nd Lieut. E. Percival, Norf. R., and to be seed.; April 22nd, seniority Jan. 30th. Temp. 2nd Lieut. J. T. G. Murison, Mach. Gun Corps, and to be transfd. to Gen. List; April 22nd, seniority Feb. 2nd. 2nd Lieut. (Temp. Lieut.) J. H. S. Alexander, Yeo. (T.F.), and to be seed.; 2nd Lieut. (Temp. Lieut.) I. Welby, M.C., Linc. R. (T.F.), and to be seed.; 2nd Lieut. S. B. Henson, E. Kent R. (T.F.), and to be seed.; April 21st, seniority from Feb. 23rd. 2nd Lieut. (on prob.) J. F. MacKinnon, S.R., seniority Feb. 23rd; 2nd Lieut. F. H. Baguley, S.R., seniority Feb. 25th; Lieut. C. H. Trotter, Canadian Gen. List, seniority March 10th; 2nd Lieut. R. J. Cullen, R. Highs. (T.F.) from a Flying Officer, seniority March 27th; April 22nd.

Balloon Commanders (graded as Balloon Officers).—From Balloon Officers, and to be Temp. Lieuts. whilst so employed:—2nd Lieut. D. C. Bauer, S.R.; April 18th; 2nd Lieut. J. W. Bradford, York, R. (T.F.); April 19th.

Equipment Officers, 3rd Class.—2nd Lieut. H. J. Taplin, S.R.; Sept. 16th, 1916. Temp. 2nd Lieut. D. C. Ellis, Gen. List; April 17th. The appointments of the following Officers, notified in *Gazette* of Jan. 2nd, are antedated as follows: To Oct. 20th, 1916.—2nd Lieut. C. B. Carr, Cyclist Bn. (T.F.); 2nd Lieut. J. Ferguson, S.R. Temp. 2nd Lieut. A. F. Lang, Gen. List to Nov. 23rd, 1916.

Memoranda.—To be Temp. 2nd Lieuts. (on prob.) for duty with R.F.C.:—H. C. C. Gates; April 23rd. M. P. Graddon, April 27th; P. L. Hutchings, May 4th. 2nd Cl. Air Mech. E. W. M. Tomlinson, from R.F.C., to be Temp. 2nd Lieut. (on prob.) for duty with the Mil. Wing of that Corps; April 16th.

Supplementary to Regular Corps.—2nd Lieut. (on prob.) C. Dolphin resigns his commission: May 11th.

2nd Lieuts. (on prob.) are confirmed in their rank:—F. D. Brooker, A. E. McKeever, D. A. McDougall, J. M. Warnock, H. W. Wheatley, R. R. Riggs, H. V. Stagg, H. J. Taplin, J. H. Valentine, A. Wyatt. To be 2nd Lieuts. (on prob.):—A. T. Hawkins; April 24th. C. N. Henderson, S. H. Cummings, W. F. Hendry, E. W. Kemp, J. W. Mayall, R. G. Nelson; May 4th.

London Gazette, May 11th.

The undermentioned to be Temp. 2nd Lieuts:

For duty with R.F.C..—Mar. 23rd: Staff Sergt. George Miller Johnstone from A.S.C.; Lce.-Corpl. Sidney Alexander Mowat, from A.S.C.; Staff Sergt. Nicholas Vincent Clarke, from R.A.M.C. (T.F.); Mar. 26th.

Flight-Commander.—Lieut. R. L. Keller, R. War. R., S.R., from a Flying Officer, and to be Temp. Capt. whilst so employed; April 28th.

Flying Officers.—Temp. 2nd Lieut. W. T. Walder, Gen. List; Mar. 10th. Temp. 2nd Lieut. C. E. Derwin, Gen. List; Mar. 16th. Temp. 2nd Lieut. J. C. Kirkpatrick, Sco. Rif., and to be transfd. to Gen. List; Apr. 13th. Temp. 2nd Lieut. (on prob.) C. L. Whitburn, Gen. List; April 16th. Lieut. J. Mitchell, M.C., R.A., from a Flying Officer (Ob.); April 18th, seniority Mar. 15th, 1916.

THE AERONAUTICAL SOCIETY OF GREAT BRITAIN.

THE Annual General Meeting of the Aeronautical Society of Great Britain will be held on Wednesday, June 13th, 1917, at 7 p.m., at the Offices of the Society, 7, Albemarle Street, London, W.

The agenda is as follows:—

To receive and approve the Report of the Council on the state of the Society, and the Balance Sheet of Aerial Science, Ltd.

To discuss and determine such questions as may be proposed by the voters relating to the affairs of the Society, and to fill the vacancies on the Council for the ensuing year. Any voter desirous of proposing any subject for discussion at the Annual General Meeting shall give notice in writing to the Secretary, which shall be received by him by noon on May 29th, 1917.

The retiring Members of Council are A. E. Berriman, B. G.

Aeroplanes v. Infantry.

"A QUEER thing happened in the sky above, both here (Roeux) and further south, near Guémappe," writes Mr. Philip Gibbs in the *Daily Telegraph* on May 13th. "As I have said, the battle took place just before dusk, the dusk of a golden day, and it was at an hour when all our aircraft fly home to roost after long journeys of adventure over the German lines, some of them with holes in their wings, and some with broken wires. In the valley of Cojeul River below Guémappe last evening at this time I watched these homeward flights, beautiful as swallows, as they skimmed high in

April 19th: 2nd Lieut. M. J. Morris, S.R.; Temp. 2nd Lieut. (on prob.) M. E. Faithfull, Gen. List.

Flying Officer (Observer).—The date of seniority of 2nd Lieut. H. R. Stewart, Gen. List, is Oct. 6th, and not as in the *Gazette* of Mar. 9th.

Balloon Company Commanders.—Graded as a Sqdn. Comdr.—Temp. Lieut. (Temp. Capt.) G. A. N. Mitchell, R. Fus., from a Balloon Co. Comdr. (graded as a Flight-Comdr.), and to be Temp. Maj. whilst so employed; April 19th. Graded as a Flight-Comdr.—2nd Lieut. (Temp. Lieut.) F. C. Mears, S.R., from a Balloon Comdr. (graded as a Balloon Officer), and to be Temp. Capt. whilst so employed; April 19th.

Balloon Officers.—Temp. 2nd Lieut. G. A. Wilding, North'd. Fus., and to be transfd. to Gen. List; Feb. 27th. Mar. 27th: 2nd Lieut. J. S. Bolton, Durh. L.I. (T.F.), and to be seed.; Temp. 2nd Lieut. (on prob.) A. R. Fairbairn, Gen. List. The date of seniority of Capt. (Temp. Maj.) J. H. Davies, Ches. R. (T.F.), is June 16th, 1916, and not as in the *Gazette* of April 16th, 1916.

Equipment Officer, 2nd Class.—2nd Lieut. G. E. Thomas, S.R., and to be Temp. Lieut. whilst so employed; Mar. 20th.

3rd Class.—Qmr. and Hon. Lieut. W. Batchelder (T.F. Res.); April 21st.

Experimental Officers, 3rd Class (graded as Equipment Officers, 3rd Class).—Temp. Lieut. W. H. Hofert, attd. Manch. R., from Mach. Gun Corps, and to be transfd. to Gen. List; Mar. 17th. April 21st: Lieut. J. C. Wallace, R.E. S.R.; Temp. Lieut. M. Cohen, Mach. Gun Corps, and to be transfd. to Gen. List; 2nd Lieut. (on prob.) A. W. Judge, S.R.

London Gazette Supplement, May 12th.

Flying Officers.—2nd Lieut. (Temp. Lieut.) E. H. Stuart, Cyclist Bn. (T.F.), and to be seed.; April 2nd. 2nd Lieut. H. S. M. Smith, Lond. R. (T.F.); April 22nd.

Flying Officers (Observers).—April 25th: 2nd Lieut. F. V. Durkin, Worcester R. (T.F.), seniority Oct. 27th, and to be seed.; 2nd Lieut. F. J. B. de S. La Terrière, Lrs., seniority Nov. 29th, and to be seed. Lieut. J. C. G. Coupland, R.F.A.; April 26th, seniority Jan. 12th. 2nd Lieut. R. M. Pegg, Durh. L.I. (T.F.), and to be seed.; April 25th, seniority Jan. 19th. 2nd Lieut. J. H. Spence, R.A., and to be seed.; April 26th, seniority Feb. 13th. April 24th, seniority Mar. 8th: 2nd Lieut. (on prob.) A. Clarke, Suff. R., S.R., and to be seed.; Temp. 2nd Lieut. (on prob.) T. Durrant, Gen. List; 2nd Lieut. F. L. Oliver, Som. L.I., and to be seed. The initials of Lieut. H. S. Taylor, Canadian Mtd. Rif., are as now described, and not as in the *Gazette* of Mar. 9th.

Equipment Officers, 2nd Class.—The appointment of 2nd Lieut. (Temp. Lieut.) S. J. Waters, R.F.C. (T.F.), notified in the *Gazette* of Mar. 10th is post-dated to Feb. 6th.

3rd Class.—Lieut. L. W. W. Lees, R.G.A., S.R., from a Flying Officer (Ob.); Mar. 26th. 2nd Lieut. F. Thomas, S.R.; April 14th. The appointment of 2nd Lieut. (Temp. Lieut.) S. J. Waters, R.F.C. (T.F.), notified in the *Gazette* of Feb. 27th, is cancelled.

London Gazette Supplement, May 14th.

Temporary Appointment at the War Office.—Staff Lieutenant.—Lieut. R. G. Cookson, R.F.C. S.R., from a Balloon Officer, vice 2nd Lieut. (Temp. Capt.) H. F. Anns, Lond R. (T.F.); April 1st.

Squadron Commanders.—From Flight-Comdrs., and to be Temp. Majors whilst so employed: Temp. Capt. B. H. Turner, Gen. List; Nov. 23rd, but without pay or allowances prior to Feb. 1st. 2nd Lieut. (Temp. Capt.) C. A. A. Hiatt, M.C., Norf. R.; Dec. 17th. Capt. J. H. S. Tyssen, M.C., Yeo. (T.F.); Jan. 22nd. Jan. 25th: Capt. G. Henderson, Ind. Cav.; Lieut. (Temp. Capt.) R. F. S. Morton, S.R. 2nd Lieut. (Temp. Capt.) C. H. Dixon, M.C., Yorks. L.I.; Mar. 26th. Lieut. (Temp. Capt.) E. O. Grenfell, M.C., R.A.; April 11th.

Flight-Commanders.—From Flying Officers, and to be Temp. Capts. whilst so employed: 2nd Lieut. J. K. Aird, S.R.; Mar. 9th. Lieut. W. E. Molesworth, R. Muns. Fus.; April 26th.

Balloon Officers.—April 24th: Lieut. (Temp. Capt.) R. C. Talbot, R.F.A. (T.F.), and to be seed.; Lieut. G. M. Dean, Can. Gen. List; 2nd Lieut. R. H. P. Hayward, R.A., and to be seed.

Adjutant.—Major C. A. Walker-Leigh, R.F.C. (T.F.), vice Capt. J. D. Strong, Ind. Army; April 21st.

Park Commander.—Lieut. (Temp. Capt.) G. E. W. Humphrey, S.R., from an Equipment Officer, 1st Cl., and to be Temp. Major whilst so employed; Mar. 8th.

Equipment Officers, 1st Class.—Temp. Lieut. J. Inwood, Gen. List, from the 2nd Cl., and to be Temp. Capt. whilst so employed; Mar. 9th.

2nd Class.—2nd Lieut. L. G. Fenner, S.R., from the 3rd Cl., and to be Temp. Lieut. whilst so employed; Dec. 14th.

Cooper, Alec Ogilvie (Squadron Commander), Mervyn O'Gorman, C.B., F. Handley Page, Colonel H. E. Rawson, C.B., Dr. A. P. Thurston and Engineer-Lieutenant G. Aldwell, R.N., who are eligible for re-election.

Nominations of candidates for election to the Council shall be signed by the voters proposing them (two voters and no more), and must be received by the Secretary by noon on May 23rd, 1917, with an intimation in writing by the voters nominated that they are willing to serve.

An Amendment to Rules 4 and 23 will be proposed by the Council to the effect that Fellows and Associate Fellows may be elected by the Council and need no longer be elected on ballot by the voters of the Society.

The Council will also ask for approval of their action in postponing, on account of the change in the offices, the date of the Annual General Meeting.

the blue fields of the air above the white cloud mountains. All their engines sang in chorus in a steady vibrating drone, clear above the noise of the guns. They had earned their rest, but did not take it. They saw the fighting down below, the British troops advancing in open order, and the Germans coming out to meet them. These droves of aeroplanes did not continue their homeward flight, and they stooped low and circled round like hawks, dropping the last of their ammunition and sweeping the enemy positions with a swish of machine-gun bullets. The men of the air fought with the men of the earth in the glow of the sunset light, which was rich and warm over these battlefields."

COMBINED METALS AND REINFORCED CASTING.

It was in November, 1914, that a first editorial visit was paid to the Combined Metals and Reinforced Casting Co., Ltd., of Point Pleasant, Wandsworth. At that date the business had but recently come into being. The idea in which the promoters saw such possibilities with a view to the betterment of castings generally and those of aluminium in particular, was one employing the aid of centrifugal force to carry the molten metal right up, and packed solid, into the smallest and most remote portion of the casting. Aluminium is not one of the easiest metals to cast in the ordinary way. It is what is known as sluggish in its flow and requires some power behind it to force it into the farthest recess of the mould before it becomes partially cooled. This was accomplished in the combined metals firm's method by bolting the casting boxes down on to a revolving platform, where they were spun at great speed, the while the molten metal was poured.

On the date above mentioned, it being remembered that the business was but just started, the plant consisted of a small portable gas-furnace, one revolving platform, and a staff of about four persons. In the intervening two-and-a-half years the staff has increased to such extent that it has been a problem to build new shops fast enough to accommodate them, and to-day a five-furnace foundry of up-to-date conveniences and principles is instrumental in the casting of three-quarters of a ton of aluminium every day, in addition to huge quantities of other metals, brass, gun-metal, and the like.

The castings as they come straight from the mould are such as to delight the eye of the expert. So clean they are that there is hardly any appearance of the sand, and when cast from plaster moulds, the subsequent machining seems almost like unto an attempt to improve on the perfect. Blow-holes are unknown, and the small pittings generally associated with aluminium castings are conspicuous by their absence. Nevertheless, machining and finishing is practised at Point

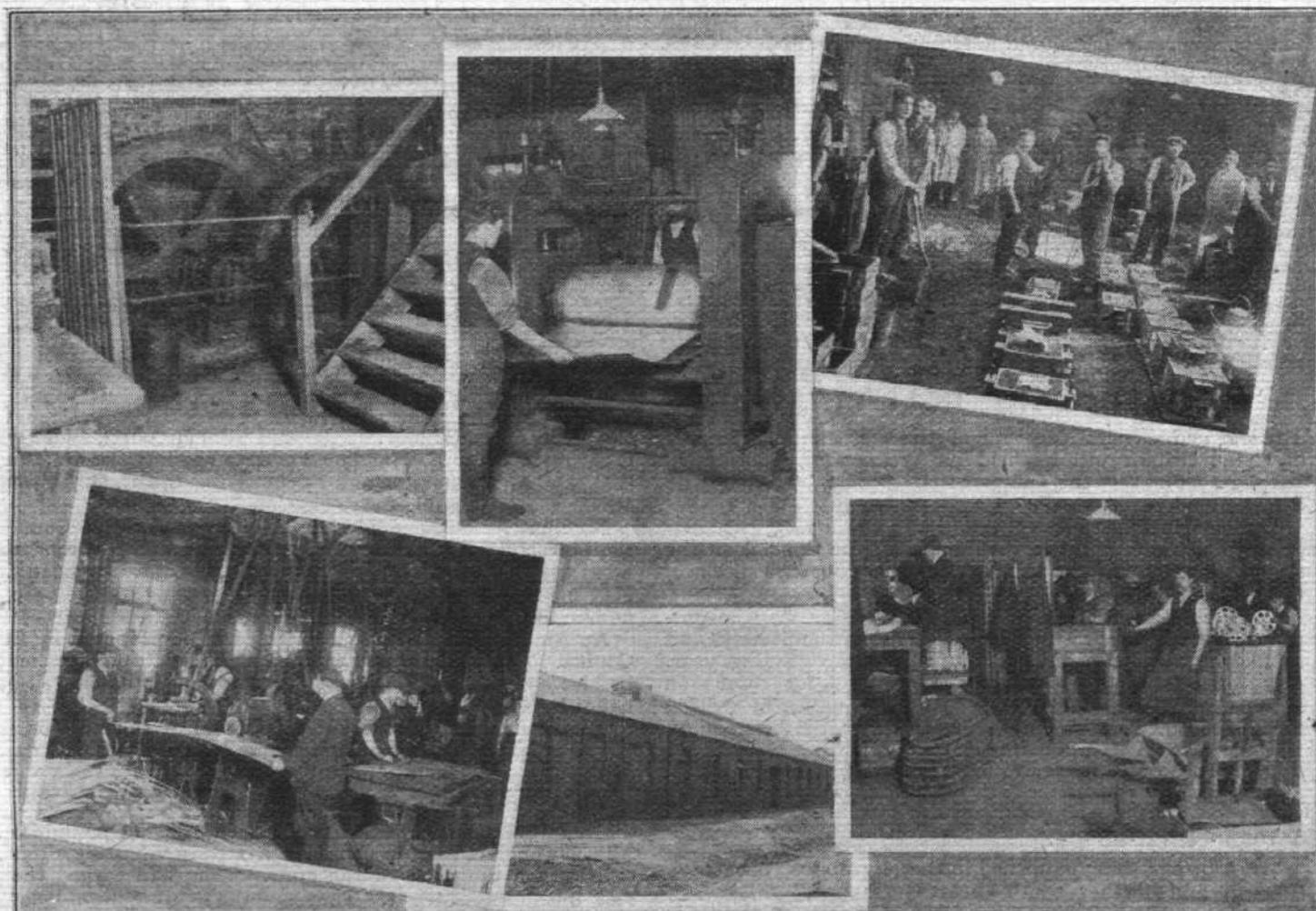
Pleasant to its utmost capacity, the result being that the finished article as ready for passing by the Air Board leaves little indeed for these discriminating officials to reject.

From the coming of the ingots of metal into the works to the delivery of the finished articles, the whole series of operations are conducted on the spot, and are under the hands of experts in their respective branches, whilst the keen and critical eye of Mr. Taylor, the Chief, Mr. R. T. Gates, the General Manager, and his very capable Works Manager, Mr. H. S. Sugden, are ever watchful of the whole process during operations.

A glance at the few pictures accompanying this article will give some small idea of the works and its activity, although it appears impossible to do justice in these matters by the aid of the camera—such a small portion of each shop is it possible to embody in the photograph. The Robertson mill is worthy of notice, driven as it is by a 300 h.p. electric motor taking 2,000 volts, which power is transferred to the rollers through the huge reduction gear shown in one of the illustrations. Here the thick billet of metal, which has been cast from the ingot, is passed between the powerful rollers with ever-increasing pressure until it emerges as a sheet of the pre-arranged gauge, ready to be trimmed on the trimming machine and despatched, after annealing, to the various aeroplane factories having the good fortune (or is it foresight?) to have their name on the Company's books.

Aluminium packing pieces, milled by patent machinery to, in the parlance of the shop, "Plus a thou' and minus a thou'," aluminium flanges, G.M. flanges for engines, control-stick knobs, star wheels, hand wheels, rudder brackets, hubs for landing wheels, all the thousand and one articles required in up-to-date aeroplane works, are here produced in quantities and in perfection.

Just a word for the benefit of those intending customers who must go and see for themselves the quality of the products



COMBINED METALS AND REINFORCED CASTING CO.—Some views in the works. Top row: left, the reduction gear of the Robertson mill, which is driven by a 300 h.p. 2,000-volt motor; centre, the Robertson mill rolling "billet" aluminium into sheets; right, in the foundry, where there are five furnaces capable of casting three-quarters of a ton of aluminium daily. Bottom row: left, in the machine shop (the machine in the foreground is trimming aluminium sheets); centre, exterior of the Company's works; right, a corner of the fitters' shop.

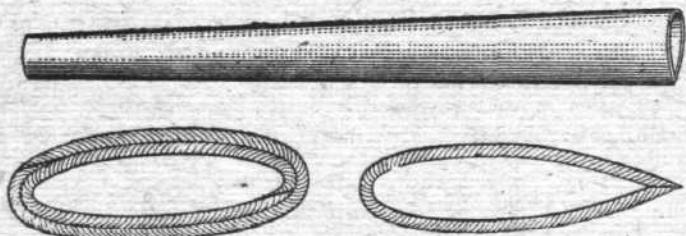
before placing an order, although in the present instance this is not at all necessary. Point Pleasant is just a little difficult to find unless one knows the lay of the land. By train to Putney Bridge, a Wandsworth car will set you down at the end of the road on making your destination known to the

conductor. Quite the simplest way is to remember that the firm's telegraphic address is "Overturned, Wands., London," and their telephone number "Putney, 2405." All other matters are settled satisfactorily before the questions relating to them are asked.

HOLLOW-WOOD SPAR AND STRUT CONSTRUCTION.

IT has long been realised by aeroplane designers that great advantages may attend the employment of hollow sections for various components of an aeroplane, such as struts and spars. With regard to the former the general practice is to make the strut of two halves, glued together along the major axis of the cross section, the two halves being spindled out to the desired extent, usually but not invariably leaving a web in the centre to make the strut stiffer against bending stresses. In the case of spars, as that term is understood in the aviation world—*i.e.*, a beam subject mainly to a bending load—there are two methods in general use. One consists in spindling the spar, whose outside shape is as nearly rectangular as the wing section will permit, out to an I section, and the other consists in making what is usually termed a box spar, that is to say, an approximately rectangular hollow section, built up of two halves joined together with hardwood tongues and glue. Other forms of construction are in use, but not to so great an extent. That new methods will be developed appears probable, since there is always room for improvement, no matter how serviceable a thing may be. Experiments have, we believe, been made from time to time with ply-wood construction, but as this method has not yet become general, it would appear that it presents some difficulty.

A system which, although resembling it to some extent, should not be confused with ply-wood construction is that



An example of the McGruer Bentwood hollow strut construction.

specialised in by the McGruer Bentwood Hollow Spar Co. of Commercial Wharf, Lambeth, London, S.E. 1. This firm make a speciality of hollow masts, spars, booms, &c., for yachts and other craft, and their special process consists in bending flat boards of wood breadthwise and joining the edges in the form of a scarf joint with glue. One of our illustrations shows two forms of construction, the one an elliptical section made of two thicknesses of wood, and the other a stream-line section bent from one piece and glued along the trailing edge. If desired, struts can be made on this principle, which taper from the centre to the ends. The wood fibres all lie parallel to the longitudinal axis of the strut, thus, it is claimed, eliminating knots and swirls. We understand that the firm have had samples tested at the R.A.F. for 12 hours in water at a temperature of 112 degrees F., and that they successfully stood the test. They have also had samples tested in cold water for 30 days without the form of the spars being affected and without starting the glued joints.

Another of our illustrations shows some actual tests on McGruer Bentwood hollow spars. The curve was constructed

$\pi^2 E$

from Euler's formula $P = \frac{(L)^2}{K}$, where P = collapsing

load of strut in lbs./sq. in. of sectional area, E = the modulus of elasticity of the material—(For good silver spruce this may be taken as 1,600,000 lbs./sq. in.)— L = length of strut in inches, and K = radius of gyration of cross section of strut. It is a well-known fact that the Euler formula only applies accurately to long struts, say to struts having a value of $\frac{L}{K}$ of 80 or over. Further, the accuracy of the Euler formula depends on the method of fixing at the ends, differences in this respect having to be allowed for. In the present case A is the result of a strut test between parallel plates; B is a

test on a similar strut between small balls in small sockets and C is a test between small balls without sockets but on hard surfaces. It will be seen that the last is as near the theoretical "loose ends" as is practicable.

On the theoretical Euler curve will also be found the letters D, E and F. These represent various struts, concerning which the McGruer Bentwood Hollow Spar Company have furnished us with the following information:—D is solid measuring 12 ft. in length \times 4 ins. in diameter, parallel, having a sectional area of 12.57 square ins., and weighing 27.25 lbs. (Spruce at 26 lbs. per cube).

E is hollow 12 ft. \times 4 ins. ext. diam. and 3 ins. int. diam., parallel, having area of 5.5 sq. ins., and weighing on the same basis, 11.95 lbs.

F is hollow 12 ft. \times 4 ins. ext. diam. and 3.5 int. diam., parallel, having area of 2.95 sq. ins., and weighing 6.39 lbs.

The Radius of Gyration (K) of D is 1; of E, 1.25; of F, 1.33; and the value of $\frac{L}{K}$ of each is respectively 144; 115; 108.

Referring to the curve of loads we see that D gives 760 lbs. per sq. in.; E, 1,200 lbs., and F, 1,350 lbs.

D's absolute load will be area \times 760 lbs. = 9,553 lbs.

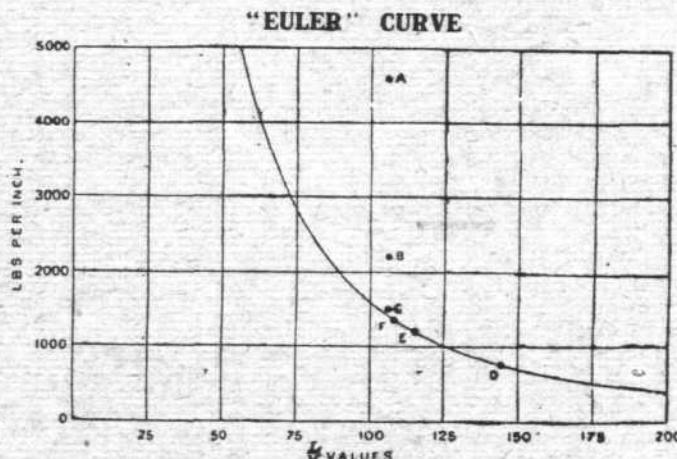
E's " " " " 1,200 lbs. = 6,600 lbs.

F's " " " " 1,350 lbs. = 3,982 lbs.

But if D's material were disposed as F's, we should get area \times 1,350 = 16,970 lbs. absolute load; and if E's material were disposed as F's we should get area \times 1,350 = 7,425 lbs. absolute load.

F or F to be just as strong, absolutely, as D, its diameter and wall should be increased to 5.1 ins. \times 0.3 in. This would make the area 4.5 sq. ins., and the weight 9.75 lbs., as against D's 27.25 lbs.

For F to be just as strong absolutely as E, its diameter and wall should be increased to 4.5 ins. \times 0.3 in. The area would then be 3.96 sq. ins., and the weight 8.58 lbs., as against



"Euler" curve of some tests on McGruer Bentwood hollow struts.

E's 11.95 lbs. Then the saving in weight, strength for strength, is obvious.

It can be tabulated as follows:

	Spar D	Spar F	Spar E	Spar F
Length	12'	12'	12'	12'
Diameter, ext.	4"	5.1"	4"	4.5"
Diameter, int.		4.5"	3"	3.9"
Area	12.57 sq. ins.	4.5 sq. ins.	5.5 sq. ins.	3.96 sq. ins.
Weight	27.25 lbs.	9.75 lbs.	11.95 lbs.	8.58 lbs.
Absolute Load	9,553 lbs.	9,553 lbs.	6,600 lbs.	6,600 lbs.
Weight Saved			64%	28%

Aircraft constructors interested in the McGruer Bentwood method of construction should apply to the firm, who will be pleased to give further particulars and furnish lists of prices.

AIRCRAFT WORK AT THE FRONT.

Official Information.

British.

"Bombing operations by our aeroplanes were continued yesterday and during the previous night, and large quantities of explosives were dropped with good results. During the day seven of our aeroplanes carried out a highly successful attack upon the enemy's observation balloons, seven of which were brought down in flames. Six German aeroplanes were brought down in air fighting, and two others were shot down by fire from the ground. In addition, seven German machines were driven down out of control. Eight of our aeroplanes are missing."

War Office, May 10th.

"*Salonica.*—Bombing raids by the Royal Flying Corps and the Royal Naval Air Service on the enemy's tents, sheds, dug-outs and transport caused much damage, 1½ tons of explosives being dropped with good effect."

General Headquarters, May 10th.

"There was again severe fighting yesterday in the air. Six German machines were brought down by our aeroplanes, and five others were driven down out of control. Five of our aeroplanes have not returned."

French.

"According to fresh reports, five German machines announced to have been seriously damaged, were actually brought down on April 24th and May 2nd, 4th, 5th and 7th respectively. Our pilots brought down yesterday two German aeroplanes, which fell in flames."

Russian.

"In the region of Karolitchi our artillery brought down a German aeroplane, which fell to earth behind the enemy's lines. In the region of Brzezany two of our aeroplanes also brought down two German aeroplanes, which fell behind the enemy's lines."

Petrograd, May 9th.

"Sub-Lieut. Navrotski brought down a German aeroplane, which fell in the region of Kozoff, to the east of Brzezany. The machine was undamaged, and its occupants were made prisoners."

Italian.

"Last night a squadron of our machines bombed the railway centre near Sesana. Hostile aircraft dropped bombs on Fogliano and Sagrado, causing damage."

Rome, May 4th.

"During the night four hostile aeroplanes bombed Gorizia without causing casualties or doing damage."

Rome, May 5th.

"Last night hostile aircraft dropped bombs on some places on the Lower Isonzo and in the neighbourhood of Cormons. At Romans one of our camp hospitals was hit and eight casualties were caused among the patients."

Serbian.

"Our airmen successfully bombed the enemy magazines at Krujevo."

Salonica, May 9th.

"Our aviators successfully bombarded the enemy encampments along their front."

German.

"In aerial battles and by anti-aircraft fire the enemy lost 14 aeroplanes. Two balloons were shot down."

Berlin, May 6th.

"Fourteen enemy aeroplanes were brought down yesterday."

Berlin, May 8th.

"On May 7th the enemy lost 20 aeroplanes. Lieut. Bernert shot down his twenty-seventh opponent and Lieut. Baron von Richthofen his twentieth."

"In the month of April the enemy lost 362 aeroplanes and 29 captive balloons. Of the former, 299 were brought down in aerial battles. We lost 74 aeroplanes and 10 captive balloons. The past month has shown the German aerial fighting forces at the zenith of their capacity. Whilst our defensive means were successfully occupied in warding off ruthless enemy bomb attacks on the Fatherland, the heavy April fighting made the highest demands on aviators, captive balloons and anti-aircraft guns in the field. In co-operation, which daily grew more intimate, they showed themselves equal to their tasks, and our bombing squadrons destroyed important military establishments. Our aerial reconnoitring operations brought valuable information to headquarters. The self-sacrificing co-operation of our aviators on the battlefield has supported in an exemplary manner the heavy infantry and artillery fighting."

Berlin, May 10th.

"Nine enemy aeroplanes were brought down in aerial battles, and one by the fire of our anti-aircraft guns."

Turkish.*Constantinople, May 6th.*

"*Sinai Front.*—Six of our aeroplanes most successfully dropped several bombs on the enemy headquarters and on one of his aerodromes."

Constantinople, May 7th.

"*Sinai Front.*—Six of our aeroplanes most successfully dropped several bombs on the enemy headquarters and on one of his aerodromes."

Constantinople, May 8th.

"*Sinai Front.*—Five of our aeroplanes attacked an enemy aerodrome and dropped some hundreds of kilogrammes of bombs on it. A fire was observed to break out in the aerodrome as the result of several hits. In spite of the violent fire of anti-aircraft guns our machines returned safely."

"Enemy aeroplanes attacked an open town and dropped bombs on the inhabitants, against whom they also opened machine-gun fire, unfortunately killing some women and children and wounding others."

Constantinople, May 9th.

"*Iraq Front.*—An enemy aeroplane was brought down behind our lines. The captured machine will be utilised by us."

Bulgarian.*Sofia, May 6th.*

"Sub-Lieut. Burckhardt brought down an enemy captive balloon east of the Cerna."



THE SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS.

A MEETING of the Council of the Society was held in the Library of the Aeronautical Society, Albemarle Street, on April 25th, when the Report of the Committee of Management was considered, and various special points mentioned in that report were discussed.

It was decided that in future these reports should be sent to all members of the Society.

Messrs. Peter Macgregor (Sanderson Bros. and Newbould, Ltd.), Frederick Best (Thos. Firth and Sons, Ltd.) and W. H. Thomas (William Jessop and Sons, Ltd.) were added to the Council as Representatives of the Aircraft Steel Makers' Committee.

The subjects discussed at the Council Meeting included the position with regard to aircraft labour questions; the effect which increased wages awarded by the Government to aircraft makers have upon contract prices; and the position with regard to National Service and supplies of aircraft labour.

It was decided that the Society should become members of the Federation of British Industries.

PUBLICATION RECEIVED.

Works Organization. By A. D. C. Parsons, B.A., E. L. Orde and G. H. Tweddell. Newcastle-on-Tyne : The North-East Coast Institution of Engineers and Shipbuilders.

Aeronautical Patents Published.

Applied for in 1916.

The numbers in brackets are those under which the specifications will be printed and abridged, &c.

Published May 17th, 1917.

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